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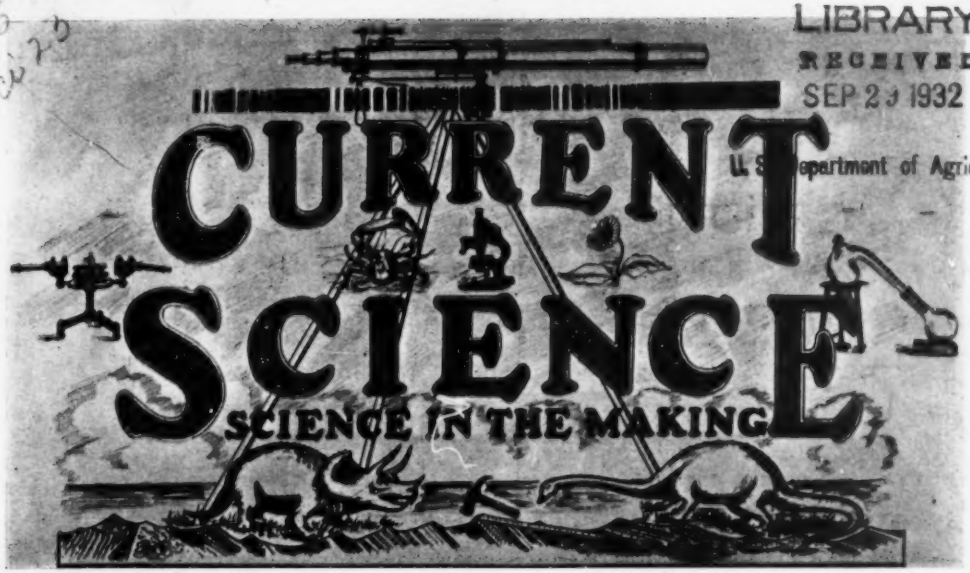

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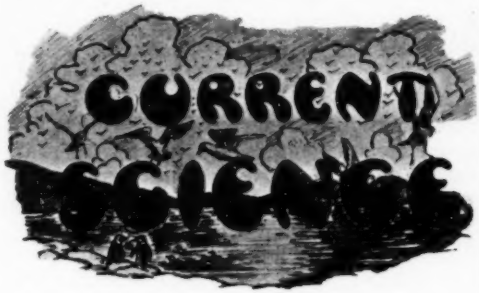

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Unemployment among the Educated Classes.

ADDRESSING the graduates at the Convocation of Agra University in 1931, Sir Ross Barker is reported to have observed, "You are like apprentices who have collected the tools of your craft. You will be judged by the way in which you will use them in after life and as you are judged the University which has equipped you will be judged." In his very commendable exhortation Sir Ross Barker evidently assumes that there is a reasonable scope for the employment of the labourer and the exercise of his tools and therefore the responsibility of using them for a high and honourable purpose belongs to the young men. The significance of these pregnant words, had they been spoken thirty years ago, might have been understood by the graduates, when the harvest was rich enough to provide employment for tools and labourers of all description. Everyone knows that to-day the output of graduates from the Universities in India is out of all proportion to the expansion of public service, industrial organizations and other big employing agencies, and the rate at which the volume of unemployment among the educated young men is increasing must fill all thoughtful minds with apprehension. It is true that the acuteness of unemployment among the labouring communities is already straining the resources of statesmanship and possibly, in this case, at least partial relief may be given by rationalizing industries and by balancing agriculture and manufactures: but surely none of these palliatives can convey hope to the educated youth whose distress is as acute as it is widespread. That a compulsory restriction of the growth of population may be relied upon to bring succour, is, in our opinion, a suggestion more facetious than feasible and no far-sighted statesman can deem his stewardship fully and satisfactorily discharged until he has contributed to the solution of the problem which sooner or later is bound to become a menace to the stability of society and the progress of the

country. To argue that the scope of the problem is world-wide and is a fit subject for the League of Nations is to betray a defeatist mind. The intricacies which beset the subject are no doubt numerous but cannot be insuperable, and should not baffle a speedy and satisfactory solution in India.

To a large extent, the Government is responsible for the creation of the present unhappy situation. Though the authors of the Education Despatch of 1854 did not intend that the University examinations should be accepted as the sole test qualifying for admission to public service, yet, in actual practice, the Government placed a most touching confidence in the University credentials and eventually succeeded in firing the ambition of the educated Indian youth to look upon administrative posts as the main purpose and aim of their life. It is readily perceived that the qualifications most necessary for the proper discharge of official duties are not precisely those tested by the public examinations and putting a premium on the University diplomas and certificates virtually therefore amounted to ignoring in the young recruits qualities such as moral character, physical fitness and the power to handle men and affairs with ability and tact. It is only in India that the University graduates (even for clerical posts till recently in Madras) are admitted unhesitatingly to almost any position in the public service. This policy of Government while it encouraged the establishment of more colleges, exercised at the same time a sinister influence on the Universities which subordinated their higher purpose (to conserve knowledge, to acquire more and to disseminate it) to the demands imposed upon them by the exigencies of public administration. The obviously unfortunate association of success in public examinations and appointments to administrative posts, produced three undesirable results: the government got men trained not for life but for examinations, the Universities specialized not in learning but in examinations and the young men in several thousands staked their all on a game of chance. So long as the majority of these young men came from communities, who, by birth, training or traditional liking and ability, possessed a greater aptitude for the sedentary labours of the desk than for practical careers in commerce, industries and other professions involving business instincts, the problem of unemployment among the educated classes was well within bounds. It has assumed a distressing magnitude, since, as a result of the awakening of the political consciousness of the people, almost a fierce scramble set in to secure government posts. This zeal, orginally stimulated for constructive national work, has, in misapplying its energies, contributed greatly to the troubles of a situation already sufficiently embarrassing. The power of absorption on the part of the Government has reached a saturation point and cannot expand in proportion to the output of graduates. The solution is fraught with delicacy and difficulty and the suggestions made here for providing alleviation are intended to invite a critical and frank examination of the complexities of the problem which, in any case, ought not to be permitted to become chronic in the public affairs of the country.

The root of the problem seems to be the maladjustment of the aptitudes of the young men to the requirements of the professions which they seek to enter, and its acuteness is perhaps due to want of a clear appreciation of the fundamental difference between the rights of an individual as a principle and his inherent powers to give effect to them in actual practice. The law of variation of types governs and adjusts the conditions of the economic life of a country and it is advantageous therefore to establish at different grades of instruction, means for the self-differentiation of young men for careers for which they possess an in-born aptitude. This prevents wastage and secures a more equitable distribution of budding talents over a wider field of human endeavour. If the whole process of education in India were a mode of differentiating talents, instead of flattening them to conform to a unified undesirable pattern, then the practical results to the communities would be beneficial and unemployment among young men would be inconsiderable.

On the other hand, the educational institutions are turning out a large number of misfits in life; young men, who possess special aptitudes to develop their parents' occupation, desire to enter government service; others who are not permitted to enter service for reasons other than qualifications, desire to take to practical careers for which they have no talents. The ideal of the educated young men ought to be to exalt labour, whether it is that of the desk or of the plough; its underlying worth is its usefulness to the community and its dignity is measured by sincerity and honesty.

It seems to us that the first step in the solution of the problem of unemployment among the educated youth of India is for all the educational institutions to give up the egregious doctrine of their power of transmutation of talents and for the Government to cease to regard university credentials as necessary passports to employment. If the Universities were freed from this burden of providing young men for public administration, they would proceed with their more legitimate functions and no longer expose themselves to the criticism that they are responsible for unemployment. The Government, on the other hand, should have, through the Public Service Commissions or other agencies, recourse to methods of selecting recruits, the basis of such selection being the possession of general education and qualifications calculated to promote the administrative efficiency and enhance the purity of service. Perhaps the second step in the solution of the problem is an increasing recognition on the part of the Government and the people alike, of the fact, that the only moral justification for expending money on the education of the youth, is that as a result of such education they acquire the necessary power and skill to improve the vocations of their fathers and possibly devise new methods of enlarging them, due provision being, however, made for those young men coming from such homes, who may possess a distinct literary or scientific turn of mind. The practical fruits of education must be the creation of more wealth in the country and the educated youth in going back to the professions to which they are born, are the real producers of such wealth.

Suggestions have been made repeatedly by public leaders, that a great part of the solution of the problem of unemployment lies in giving education a "vocational bias". Apart from the intial cost, the success of this experiment depends upon a number of factors like traditional aptitude for craftsmanship, capital for establishing new industries on a small scale or to improve the old ones and protection of markets from an undue pressure of foreign competition. Besides the absorption of young men in the professional callings of their fathers, the more gifted among them must find new openings in industries, commerce and business combines equipped with technological and statistical laboratories. It would be most wasteful of time, labour and money if the young men specially trained for a definite practical career were to be drafted into clerical posts under government service or if those who have no aptitude for such technical professions should be forced into them under economic pressure. One of the reasons why the experiment of Agricultural Colonies for graduates has not become popular is that they were intended practically for those who possessed no hereditary instincts to such avocations and others who possessed them were drafted into administrative posts where they had to acquire aptitudes new to their traditional abilities and likings. To stop this waste of human talents produced by forcing men into callings adverse to their fullest developments, whatever may be the social theories in its support, would mark the beginning of a new era of economic prosperity. There are several minor side-industries which an young agriculturist equipped with practical biological training, might develop, such for instance as cattle-breeding (including dairy-farming), fruit growing and preservation of fruits, sheep-rearing, poultry-farming and apiculture. Prejudices and false notions of dignity of labour are a serious handicap, the removal of which ought to provide relief to unemployment.

Further, if India is not made safe for talented educated Indian youth to enter any

branch of service under the administration of the Imperial Government including the Army, the Navy and the Church,—provided they possess the requisite qualifications,—and recruitment elsewhere for these services does not stop, it is feared that the canker of unemployment will slowly undermine the very structure of the body politic, tending towards extremely undesirable manifestations. The Indianization of railways is a matter of extreme urgency and will provide employment to a large body of duly qualified Indians. To a very great extent, the solution of the problem in India is bound up with prejudice and vested interests, which have promoted its acuteness. The tools and the labourers to which Sir Ross Barker referred in his Convocation address are there, and are not unworthy; but the expansion of the field for the employment of both is the province of statesmen, the great industrial and commercial magnates, the landed aristocracy and business corporations.

Chemistry and Currency.

By Dr. Gilbert J. Fowler, D.Sc., F.I.C.

TO the Biochemist the phenomena of life present a wonderful picture of energy transformations, controlled by marvellous mechanism, and in all their complexity conforming to fundamental quantitative law.

Thus, for every intake of food there is a definite output of energy, either in the form of physical or mental work, or of heat.

This is becoming well recognized by up-to-date food vendors and manufacturers, and the careful housewife, especially if she is American, calculates and adjusts her menus in calories. On the door of the weigh-house, at the entrance to the Mysore City sewage farm, is a list of the vegetables sold, and their corresponding energy values, expressed in calories.

In the last annual Memoirs and Proceedings of the Manchester Literary and Philosophical Society, which has just come to hand, there is an interesting reprint of a short autobiography of Dr. J. P. Joule, which has recently come into possession of the Society, in which he states that in 1841 he found that, "the quantities of heat evolved by the combustion of the chemical equivalents of bodies are proportional to the intensities of their affinities for oxygen." Thus Joule may be said to be the father of modern quantitative dietetics.

Long before the date of Joule's discovery Adam Smith wrote as follows in "The Wealth of Nations":—

"Labour alone, therefore, never varying in its own value, is the ultimate and real standard by which the value of all commodities can at all times and places be estimated and compared. It is their real price; money is their nominal price only.....

"The real value of all the different component parts of price, it must be observed, is measured by the quantity of labour which they can, each of them, purchase or command. Labour measures the value not only of that part of price which resolves itself into labour, but of that which resolves itself into rent, and of that which resolves itself into profit.....

"Food is in this manner not only the original source of rent, but every other part of the produce of land which afterwards affords rent derives that part of its value from the improvement of the powers of labour in producing food by means of the improvement and cultivation of land."

Have we not in the work of Joule a means of measuring exactly the labour which Adam Smith declares is the only true basis of value?

Here let us at once guard against a misconception. Adam Smith never intended to say that the *value* of each man's labour was the same, but that it constitutes a *standard* by which the value of other commodities can be measured. Adam Smith sensed the fundamental fact which the work of Joule put into scientific form that

every adult individual requires a certain minimum amount of food in order to be able to expend an equivalent amount of *energy*. How that energy may be applied is another question; a dynamo may turn out so many units of electrical energy per hour, which may be expended in lighting a room or in firing a mine, the amount of energy may be the same in both cases, the effects are different. Therefore, both "Poet and Peasant" require, within certain limits, the same amount of daily food, but the energy set free may be expended in the one case in writing poems on the delights of a rural existence, and in the other in actually digging potatoes for the poet's sustenance.

Considerations such as the above have led to the idea of a fixed datum for currency, based, not on metal, but on *Energy*, combined with the most constant element in the human food ration, *viz.*, *Nitrogen*. This datum has been termed the ERN, from "Erg" the unit of energy and N the symbol for nitrogen.

The daily nitrogen ration, according to Professor Rose of the University of Illinois, (Dietary Facts and Fads, *Ind. and Eng. Chem.*, June, 1931) is 10 grams, and the equivalent energy 300 calories. The actual value of one ERN on this basis is therefore 300 calories multiplied by 10 grams of nitrogen.

Nitrogen is chosen as a basis because, of all the constituents of the total food ration, its consumption fluctuates within the narrowest limits, 10 grams per capita per day representing a fair average.

An obvious criticism is that all kinds of nitrogen compounds are not of the same nutritive value, but in actual practice, nitrogen as a commodity has its average price, which is controlled by the quantity available and the demands of agriculture. The elemental nitrogen, as it originally exists in the atmosphere, may properly be taken as a basis, since it passes during its cycle from the air to the nitrogen-fixing bacteria in the soil, from them to the plant, from the plant to the animal, and back again to the soil, whence by reason of sundry denitrification changes, it again assumes its elemental condition, and passes back into the atmosphere. During this cycle it has entered into countless different combinations, the resultant energy of which, liberated as they pass through the human body, averages some 300 calories per day.

Having once decided upon the value of this basic datum, the ERN, in terms of normal currency in a year of average prosperity (1928 has been suggested), the value of all other commodities can readily be calculated in terms of ERNS. In a recent speech, Mr. Winston Churchill states that the prices of thousands of commodities have kept in step with one another, gold alone has broken the ranks.

With the ERN as our standard we should have a constant basis for our commodity prices.

The ERN does more than this. Owing to the two interdependent factors, energy and nitrogen, it provides a means for equating mechanical power and agriculture. The machine is only an extension of a man's hand. One man, kept alive by food purchased by so many ERNS, can operate a machine liberating units of energy in abundance. The labour and intelligence of man can harness the Cauvery Falls and light up the towns and villages of the Mysore State. The energy thus utilized represents so many ERNS. On the other hand, without the nitrogen, provided by the labour of the agriculturist, the man at the machine cannot function. The combined value of the food and of the energy which this sets free, either immediately or ultimately, constitutes the *real* wealth of the State. This is living wealth. Gold is *dead*. What can it *do* in "its long, indirect and solemnly idiotic journey to be sterilized in the vaults of the hoarding powers"? (H. G. Wells, "*The Work, Wealth and Happiness of Mankind*," p. 381.)

With the ERN as our standard of currency there would ultimately be no need to hoard. So long, as the sun shines and the sea endures and the intelligence of man has free scope, he has wealth and to spare in the forces which he has at his disposal.

As Professor Soddy reminds us—"with the doctrine of energy, the real capitalist proves to be a plant" ("*Wealth, Virtual Wealth and Debt,*" p. 30.)

The practical measures necessary to introduce an ERN currency, and the social and political results which would follow, may well provide subject-matter for further articles.

The Future of Agriculture in India.

THE importance of Agriculture to India has been realized to a greater extent during recent years than at any other time in the history of the country. The report of the Royal Commission (1928) presents a searching enquiry into the various problems at issue and the best means of solving them : the Imperial Council of Agricultural Research constituted on their recommendation has continued their good work and has already rendered valuable service to the country. Various new schemes have been sanctioned and researches leading not only to increased yield but also to improved quality undertaken. The provincial agricultural departments, as also those of the Native States, have also redoubled their activities and chiefly as the result of their efforts combined with those of the irrigation departments, larger areas are coming under cultivation, more valuable crops are displacing the cheaper ones and superior and high-yielding varieties are taking the place of the inferior strains. All these would augur well for the prosperity of the country—richer harvests and larger returns for the farming classes, cheaper and more plentiful food and clothing for the others and increased trade and wealth for the nation. Is such really the case ? If not, what is our present position and what are we heading towards ?

A study of the trade returns* for the past few years would show that the prices of agricultural produce have been steadily falling and that the exports made up chiefly of textile fibres, food grains and oil seeds have already shrunk by nearly 50 per cent. There is financial distress all around and the suffering, particularly among the agricultural classes, who constitute 75 per cent of the total population, more acute than ever before. Is the present depression a momentary one caused by fluctuations in currency and political troubles or is it a more serious condition likely to lead to further distress unless new remedies are found ?

The position would be clarified when it is realized that the present agricultural awakening is not confined to India alone ; in fact, other countries had started long before India began. Starting with Sir William Crookes,* a succession of authorities had predicted food shortage in the World unless more is produced ; even recently, Sir Daniel Hall† has expressed profound uneasiness at the inadequacy of the present supply to meet the growing needs of Western countries. The experiences of the War have also taught many a country to be independent of the others for their food and clothing. As the result of the above we find almost every country in the World producing more than it ever did before.‡ Export trade in agricultural crop has shrunk and countries like India which have subsisted mainly on the produce of the land have been seriously hit. There is yet no suggestion of acute over-production except in the cases of rubber and tea but such a condition is bound to extend, beforelong, to other crops as well.

Before considering any remedial measure, it would be essential to determine whether there is any real cause to fear shortage of food supplies at least in the near future. Taking merely the cultivable lands into consideration, we find that only a small fraction of the World's extensive areas have so far been brought under the plough. Thus, Canada has still over 350 million

* *Review of Trade in India*, 1928, **54** ; 1929, **55** ; 1930, **56** ; 1931, **57**.

* *Repts. Brit. Assocn.*, 1898 (Bristol), 3.
† *Repts. Brit. Assocn.*, 1926 (Oxford), 255.
‡ *Int. Rev. Agric.*, 1928, **19** ; 1929, **20** ; 1930, **21**.

acres of potential farming land* and India over 100 million acres of cultivable waste†; United States has still about 60 million acres eminently suitable for raising wheat; Russia, Siberia, Australia, Argentine and South Afrcia, to speak of only a few, have also millions of acres which can be readily brought under cultivation. The above and other bigger countries of the World have so far found it paying to adopt the extensive system of farming according to which although large areas are brought under cultivation no special attempt is made to increase the yield per unit area. The experiences of small but self-contained countries like Belgium and Denmark have, however, shown that under the 'intensive' system of farming the yield per unit area can be increased at least four-fold. Assuming that a large part of the uncultivated areas come under the plough and that the intensive system of farming is adopted in many of the bigger countries, there would soon be enough food and clothing for at least four times the present population of the World so that there would appear to be no prospect of food shortage for at least a few centuries to come!

The general panic is, however, still there, as also the ambition to capture the hypothetical agricultural markets of the World. Europe has so far been the chief importer of agricultural produce from abroad, but there will soon be the danger of over-production in Europe itself; indeed, as Speyer‡ has stated, if all the European countries are to adopt the use of moderate doses of nitrogenous fertilizers there would be no consumption for half the extra crop thus produced! It would be obvious from the above that the demand for Indian grains would soon steadily decrease.

It may be argued that India may still hold her own in cotton, oil-seeds and other tropical products. The developments of the past few years§ have, however, shown that even there her position is not very secure. In addition to United States, there have now sprung up new rivals in Uganda, Sudan and Russia on the cotton market. In the oil-seed trade, West Africa and South America are steadily ousting India from the European market. Ceylon and Dutch East Indies have set up as serious rivals in tea. Russia has already monopolised the hemp trade and East Africa that in many of the spices. Brazil is already overproducing coffee and Malaya, rubber. There is yet no cause for serious alarm, but we cannot be blind to the possibility of further shrinkage in export trade and depreciation in the value of agricultural produce, thus resulting in general distress to the farming classes who form the bulk of the country.

What is to be the remedy? Restriction of World's output would be a solution, but most countries will not adopt such a policy and even if they do, they will not follow it; so it will end disastrously to those countries that observe such a compact. Tariffs will, no doubt, protect the country from foreign products being dumped in and help by preferential treatment or otherwise to assist in the assimilation of raw materials by some of the manufacturing countries. Such a course will only be a palliative and will not save the country from internal overproduction and the consequent distress.

The real solution of the problem would be apparent when it is realized that whereas there is one method of producing a crop, there are several ways of utilizing the produce. India has so far been confining her attention to the production of raw materials rather than to the preparation of finished products. To one acquainted with interrelation between things, agricultural products represent vast store houses of energy bound up with various types of sugars, proteins, fats and such basic principles from which most of the other products required for the comfort and well-being of mankind are derived. Yet, neither the farmer nor the country gets very little out of them. Taking just a few instances we find that almost all kinds of energy producing materials can be obtained by either

*Greig, *Repts. Brit. Assocn.*, 1929 (S. Africa), 230.

†Clarke, *Proc. Ind. Sc. Cong.*, 1930, **17**, 23.

‡*Nature*, 1929, **123**, 54.

§*Int. Rev. Agric.* (*loc. cit*).

fermenting or otherwise treating different plant products which now find practically no application: the products thus obtained can also be used as solvents in industry; they may be treated in a variety of ways and be made to yield numerous products required either in medicine or for various types of arts and manufacture. Thus, starting from some of the commoner vegetable materials it should be possible to prepare a number of alcohols, organic acids and esters; starches, gums, dextrins, different types of adhesives, distempers, etc.; paints, varnishes and enamels; disinfectants, antiseptics, insecticides and fungicides; essential oils, perfumes and cosmetics; various cellulosic materials including lacquers, mercerised cotton, artificial silk, and explosives; numerous dyes and pigments; various types of waxes, resins and allied products; numerous drugs and medicinal substances; and different digestive ferments used in medicine and industry. Even among articles of food there are various types of infant and invalid preparations, preserves, pickles, jellies and such like, all of which are in great demand in all the civilized countries of the World. The above are only a few of the numerous known methods of utilizing surplus agricultural produce; the efforts of the scientist combined with those of the industrialist can also produce several new ones so that the possibilities of such applications are almost inexhaustible.

The agriculturist and the industrialist, at any rate in India, have so far moved apart, the former being more interested in the disposal of his harvest than in utilizing them to obtain better returns and the latter, generally, in textiles and machinery. The time is now come for them to combine and utilize their resources to mutual advantage. Each is, however, yet unaware of the precise position of the other and it is for the Government to bring them together. It may not be too much to expect that realizing the importance of the problem, the Government would appoint a Commission composed of representatives of agriculture, forestry, industry and applied science to enquire into the matter and advise them with regard to the best means of bringing about active co-operation between the organizations concerned. The terms of such a Commission should no doubt include the exploration of means of maintaining the organizations concerned in continuous touch with each other's difficulties and the employment of a band of workers who will investigate the problems at issue in their proper perspective. A beginning can even now be made with (*a*) agriculturists, and industrialists holding frequent joint conferences to decide on the most suitable problems for investigation; (*b*) the Imperial Council of Agricultural Research including agricultural industries in the purview of their enquiries and setting aside a part of their funds for the furtherance of researches on that subject; and (*c*) the provincial agricultural departments having a special staff attached to their laboratories primarily for the investigation of methods of utilizing agricultural produce. Much more remains yet to be done; but a beginning of the realization of problems at issue will itself have the desired moral effect and go a long way towards the alleviation of the present distress among the agricultural classes and ward off many that might arise in the future.

Breeding of Trochus and Preservation of the Beds in the Andamans.

By C. Amrithalingam.

TOP or Pagoda shell (*Trochus niloticus* Linn.) occurs in abundance, within the five fathom limit, in the Andaman and Nicobar waters and has been fished for some time by various Japanese firms for the manufacture of paint, tooth paste, mother-of-pearl buttons, etc. It was only in recent years that the Andaman Administration was made aware of the economic importance of this fishery and so proceeded to take steps to establish it on a permanent basis. As the various stages of the life-history of this mollusc had not been investigated, it was found necessary to determine the breeding season, etc., before the *Trochus* fishing could be controlled properly. My work on the boinomics of this shell-fish revealed that it starts spawning in April and continues spawning till the commencement of the south-west monsoon.

From the inception of legalized shelling industry in the Andaman and Nicobar waters, the accepted season has been from 1st. October to 30th. April, *i.e.*, seven months. This year, according to my suggestion, while I was a Research Officer, Andaman Fisheries, the shelling season is expected to start on the 1st. September; I did not suggest a closing date as I had not then discovered the breeding season of *Trochus niloticus*. Now that it is known that this mollusc starts spawning in April, it is but evident that the fishing season should be closed on the 31st. of March.

By changing the fishing season from 1st. October–30th. April to 1st. September—31st. March, the breeding individuals will not be fished, and thus the beds will be saved from depletion; this suggestion, if accepted, will ensure the restocking of beds without any loss of the current revenue from this source, as shelling-season will last for the same length of time as in previous years.

On the Bombay coast too, Mr. Hardit Singh Rai* finds the necessity of observing a close season in the fishing of marine economic animals during the breeding period. It is evident, therefore, that in legislating for the control of marine industries in the Indian waters, special attention should be paid to the breeding period of the species concerned in much the same way as laws regulating Game Birds.

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* *Jour. Bombay Nat. His. Soc.*, **35**, 834, 1932.

"The Rôle of Organic Matter in the Soil."

INAUGURATING the symposium on "The Rôle of Organic Matter in Soils," held under the auspices of the Society of Biological Chemists (India) on the 30th. July, Dr. Fowler, who presided, outlined the present position of the problem. The foundation of agriculture is soil fertility which is considerably influenced by the organic matter present in the soil. The extensive work of Howard in India definitely showed the vital importance of root aeration in relation to crops. Organic matter, by affecting the texture of the soil, effectively helps the aeration and moisture conservation in soil, thus providing optimum conditions for the micro-organisms to flourish; it affects the reaction of the soil, and the viability of the microflora especially the nitrifying and denitrifying organisms. The importance of the products of oxidation of organic matter in the soil is not to be ignored. There is again the famous auximone theory of plant stimulation put forward by Bottomley. The carbon/nitrogen ratio is a very acute question which has a bearing on the chemical aspects of the problem. Finally, the organic matter in the soil affects the vitamin value of the crop produced. He hoped that the several speakers would deal with these subjects and would materially contribute to our knowledge of the problem.

Dr. V. Subrahmanyan, discussing the microbiology of the decomposition of organic matter in the soil, outlined the essential factors concerning this aspect of the subject. The nature of the organisms, which are selected from the natural flora of the soil, are determined by the chemical composition of the organic material, soil conditions and climate. The mechanism of the slow conversion of dead microbial cells into plant nutrients, of which definite evidence exists, is obscure. Physical texture, aeration, light, moisture, reaction, treatment with minerals and system of cropping are factors that determine the nature and activity of the organisms occurring in the soil. There is yet no satisfactory method available for the study of the nature or activity of the microflora concerned in the decomposition of organic matter in the soil. Excessive quantities of organic substances are accompanied by marked change in the associated fauna and flora; bacteria are suppressed and a variety of pathogens develop. Either fallowing or partial sterilization by heat or antiseptics restores the soil to normal biological equilibrium. Among the many fundamental problems on the decomposition of organic matter in soil awaiting solution are, the standardization of conditions leading to economy of carbon and conservation of nitrogen, study of conditions leading to loss of nitrogen and those favouring fixation, the physiological transformations undergone by various putrefactive and pathogenic organisms associated with different organic materials applied to the soil, and steps to be taken to avoid sudden outbreaks of various plant and animal diseases.

Dealing with the chemical aspects of the problem, Dr. Mirchandani showed that there were still many gaps in our knowledge of the decomposition of organic matter in the soil. Of the several factors determining the decomposition, he considered C : N ratio of the organic matter as the most important. From the decomposition studies of many substances, individual as well as mixtures, of varying C : N ratio, he concluded that a ratio

of 16 was the most desirable one if benefit was to be derived from the added organic matter; and the further the ratio was removed from the optimum, the further was the period of nitrogen deficiency in the soil. The effects of narrow C : N were also described and stress was laid on the need for the proper regulation of the decomposition of organic matter by adjusting its C : N ratio.

Mr. G. S. Siddappa, in presenting a paper on "Organic matter as direct source of plant nutrition", traced the history of the subject from 1837 to date. It had been recognized from the early days of agricultural science that organic manures were very beneficial to crops. There is a school of opinion which holds that the effect of decomposing organic matter is to provide additional carbon dioxide for plant growth. This is not entirely unchallenged. The exact history of the rôle of organic matter as direct source for plant nutrition or stimulant dates from the announcement of the "auximone theory" by Bottomley and Mockeridge in 1912. The recent work on the necessity of "bios" for the growth of yeast adds one more proof to the subject. This subject has been the centre of keen controversy and numerous are the experiments done to uphold or reject the theory. The evidence at present points very strongly towards the truth of the theory. Recent experiments at the Indian Institute of Science on the effect of injection of extracts of yeast and farmyard manure on the growth of *Helianthus annus* has strikingly confirmed the presence of plant stimulants in organic matter that influence the growth of plants quite out of proportion to their quantity. Further work on the subject is being carried out.

Rao Bahadur B. Viswanath spoke on the relative advantages of the use of organic and mineral fertilizers. In India, the soil is remarkably poor in carbon and nitrogen as compared with European and American soils. The importance of manuring soil is, therefore, much greater here than elsewhere. Graphs were shown, and experiments conducted at Coimbatore were outlined to illustrate that organic manures have very much greater effect on plant growth than inorganic mineral fertilizers. The effect of the organic manure is more lasting and better. Although the mineral fertilizer may show an advantage in the earlier stages, these fall off slowly and steadily so that finally the organic manure triumphs. The seeds obtained from plants grown on organic manure have a decidedly better nutritive value as shown by Col. McCarrison in his dietetic experiments on rats. The straw was also found by experiments in Coimbatore to be of greater food value to domestic animals. The seeds, moreover, inherited the qualities of the parent crop in their quality and quantity of growth. It is, therefore, very essential that we should conserve our organic manures very carefully and utilize them to the best advantage.

Mr. P. V. Ramiah contributed a paper on the bearing of organic manures on animal nutrition. Cereals grown on cattle manure always possessed higher nutritive values. This could not be ascribed to higher protein content. In fact there was less nitrogen in the grains grown on cattle manure plots. Vitamin assays of these grains were conducted both at Coimbatore and at Coonoor and showed that they always possessed higher values. Plimmer has shown that the vitamin B content of a diet greatly influenced the nucleo-protein metabolism. This may be extended to other constituents of the diet and may be mainly responsible for the difference observed in these nutritive values. Thus, there is a close relationship existing between soil, plant and animal. By manuring the pasture lands with ammonium sulphate the amount of sulphur metabolized by the sheep grazing on them can be greatly enhanced thus leading to an increased output of wool. One could thus manure either for milk, wool or meat as is required.

Mr. Viswanath opening the discussion on the subject, took up the problem of plant stimulation. The experiments conducted at Coimbatore showed that minute quantities of substances like yeast extract stimulated plant growth to enormous extent. Although Russell in his latest edition of the book on "Soil conditions and plant growth" still wrote that the influence of organic matter lies in its effect on the texture of the soil, the matter is not so simple as that. The work of Bottomley and later by Ashby and others point to the existence of certain plant stimulants which catalyse plant-growth and which function in the presence of micro-organisms. The relative results obtained with the use of yeasts, yeast and mineral fertilizer, mineral fertilizer alone and ordinary farmyard manure, showed that the best effect was obtained with yeast and mineral fertilizer and that yeast alone is much superior to other treatments. The grains from the stimulated ones, when sown, take up greater nutrition from the soil than the untreated ones. The yield of straw and grain is greater. The nutritive value of plant and seeds obtained by yeast stimulation was better than unstimulated ones. The evidence points to a clear relation between vitamins and auximones, thus establishing a sort of cycle between animal, plant and bacteria.

Dr. B. Sanjiva Rao raised the point of the rôle of inorganic catalysts in the decomposition of organic matter in soil. Indian soils are notorious for the rapidity with which the organic matter is depleted from them and this is more so in the case of laterite soils, where ferric oxide is present, than in other soils. He suggested the possible rôle of ferric oxide as a catalyst in the decomposition of organic matter in soil.

Dr. Fowler drew attention to the experiments carried out at Rothamsted where it was definitely shown that small traces of boron have great effects on plant growth.

Mr. M. Sreenivasaya suggested the possibility of applying tissue culture methods in place of the usual pot culture ones for the study of these problems. He pointed out the economic importance of the necessity of finding out whether the qualities of seeds grown on organic manure persist for a few generations. He suggested that experiments on the activation of enzymes by yeast extracts like diastases in starch elaborating plants and proteases in legumes could be advantageously tried to study the problem of plant nutrition.

Mr. A. V. Varadaraja Iyengar suggested the use of plants reared on a 'basal diet' on an analogy with animal nutrition experiments. The importance of the quantity of mineral fertilizers on the decomposition of organic matter should be considered.

Mr. B. N. Sastri pointed out the inadequacy of controls used in some of the experiments conducted and suggested the injection of ash constituents for the control plants. He drew attention to the fact that traces of inorganic constituents were known to stimulate the growth of plants, much in the same way as the auximones whose existence has been postulated.

A detailed report of the symposium will shortly be issued by the Society of Biological Chemists (India).

K. S. VARADACHAR.

Investigation of the Solar Corona without an Eclipse.

By Dr. K. R. Ramanathan, D.Sc.

THE study of the solar corona has been, till recently, confined to short intervals during total solar eclipses, when the overpowering light of the sun is shielded from the earth by the moon's disc. In a paper read before the French Physical Society by M. Bernard Lyot of the Meudon Observatory near Paris an experimental technique worked out by him was described which provides a new method for investigating the light of the corona at all times when the sky is sufficiently clear and thus gathering more knowledge regarding this outer extensive tenuous envelope of the sun.

The most important obstacles to the observation of the comparatively feeble light of the corona under normal conditions are: firstly, the scattering of light by the solid and liquid particles suspended in the atmosphere and secondly, the scattering of light by imperfections in the optical system of the instrument used in the observation. The scattering by the gaseous constituents of the atmosphere are of comparatively little importance.

The only way of getting over the first difficulty is to make the observations from a high-level station which lies well above the low-lying dust layers and at times which are comparatively free from atmospheric disturbances. Mons. Lyot made his observations from Pic der Midi in S. France with an elevation of 2,800 meters above sea-level. Using a faultless telescopic objective and stopping it down to about 4" diameter, he formed an image of the sun on a blackened disc whose diameter exceeded that of the sun's image by a few seconds. Another lens placed behind the disc produced an image of the first lens on a diaphragm whose centre was occupied by a small opaque screen. The edge of the diaphragm cut off the light diffracted by the edges of the first lens and the small screen stopped the light of the sun's image formed by internal reflection from the faces of the first lens. A well corrected objective placed behind the diaphragm and screen formed an image of the corona.

Examining the image with an eyepiece the prominences could be seen round the edge of the sun with a rosy red colour. When the atmospheric conditions are particularly good, the corona also could be photographed using a red filter.

Placing the slit of a spectrograph tangential to the image of the disc, the red and green rays of the corona (6375 A and 5503 A) could be photographed.

It is hoped that by installing one of these instruments in a selected high level station, it would be possible to follow day-to-day changes of solar corona and investigate its relationship to prominences and sunspots and perhaps also to related terrestrial phenomena such as magnetic storms and the reflection of electric waves from the upper atmosphere.

Letters to the Editor.

[The Board of Editors do not hold themselves responsible for opinions expressed by correspondents. No notice is taken of anonymous communications.]

The Antimony Electrode in Soil Work.

THE antimony electrode has been under trial for some time in this laboratory in connection with the pH determination of soils. Various relationships have been obtained by different workers between electrode potential and pH value. Using Clark's series of buffer mixtures and an eletrode prepared from Kahlbaum's specimen of metallic antimony against the saturated calomel electrode (temperature 27°C) the following relationships were obtained for each of the ranges pH4—pH7, pH7—pH8 and pH8—pH10.

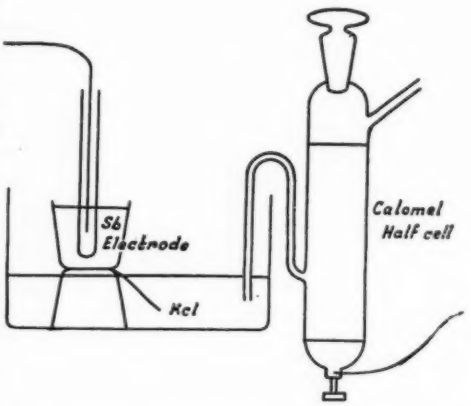
Range of pH	Equation connecting E with pH.
4—7	$pH = \frac{E - .0129}{.05530}$
7—8	$pH = \frac{E - .2029}{.02969}$
8—10	$pH = \frac{E - .0215}{.05288}$

Best* obtained somewhat different equations connecting E and pH.

The electrode was apt to behave erratically for several weeks after preparation but after stability had been established continued to behave consistently in conformity with the above equations.

For the determination of the pH of soils the following method has been found to be both convenient and satisfactory.—

A disc of filter paper cut to size is placed at the bottom of a gooch crucible and the latter three quarters filled with the sampled soil. The crucible with the soil is placed in a flat dish with enough water at the bottom to completely saturate the soil and the whole is left under a bell-jar over night. The soil is then transferred to a porcelain dish, thoroughly stirred with a glass rod or spatula and returned to the gooch after placing the disc of filter paper in position. The rest of the arrangement could be seen from the diagram below :—



The above arrangement ensures the wetting of the soil to its maximum saturation capacity, a condition which experience has shown is conducive to reproducible results being obtained.

Contact of the bottom of the crucible with the solution of potassium chloride which serves as the liquid junction is effected by a strip of blotting paper.

T. LAKSHMANROW.
Physical Chemistry Section,
Chemical Research Laboratories,
Agricultural Research Institute,
Coimbatore,
June 30, 1932.

*Best, *Jour. of Agri. Sc.*, **21**, 344.

Mechanism of Respiration in Hill-Stream Fishes.

THE normal mode of breathing in a fish consists of an inspiratory and an expiratory phase. At the commencement of the former, the mouth is opened a little, and the external gill-openings are kept tightly closed. At the same time the hoop-like gill-arches expand, and consequently, there is an enlargement of the cavity of the

pharynx. As a result of these actions a stream of water is drawn into the pharynx. During the expiratory phase, which follows soon after, the mouth is closed tight and the pharynx is contracted. The water is thus driven out of the pharynx and, after passing over the gills, is expelled through the external gill-openings.

In the hill-stream fishes, in which the mouth is small and is situated on the ventral surface considerably behind the tip of the snout, this mode of breathing is hardly possible, firstly because most of these fishes lie closely pressed to the substratum, and secondly because the mouth is usually surrounded by broad lips which enable the fish to adhere to rocks and stones in swift currents. As a result of these modifications, the mouth is not in contact with any large

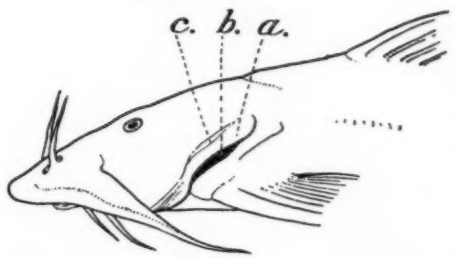


Fig. 1. Lateral view of Head and anterior part of body of *Glyptothorax pectinopterus* (McClelland). *a.* opercular flap; *b.* gill-opening; *c.* limit of the bony operculum.

quantities of water. In 1923,* it was observed by me that in *Glyptothorax*, *Pseudecheneis*, *Garra* and *Balitora* the mouth remains open throughout the process of respiration, and recently Mr. D. D. Mukerji has found that this is also true in the case of a totally different type of fish *Amblyceps mangois* (H.B.). It has been ascertained that in these fishes the respiratoy current is initiated and carried on by the vigorous pumping action of the opercular flaps. In the Indian hill-stream fishes it is the upper portion of the opercular flap that performs this function, whereas in *Loricaria* (Hora, 1932*) it is the lower portion that is specially modified for the same purpose.

This method of respiration in hill-stream fishes probably serves a double purpose. Besides the oxygenation of the blood, the pumping action of the opercular flaps sets up a strong current on the underside of the head of the fish when the water is sucked in through the mouth. The currents produced by the respiratory movements result in lowering the pressure on the ventral surface of the head and the animal is enabled to stick to the substratum more firmly (Hora, 1930).†

In certain highly specialized torrential fishes, such as *Gyrinocheilus of* Borneo and Siam and *Arges* of the Andes in South America, the mouth no longer serves as a passage for the inspiratory current, and the branchial openings are modified in a remarkable way. Each gill-opening is

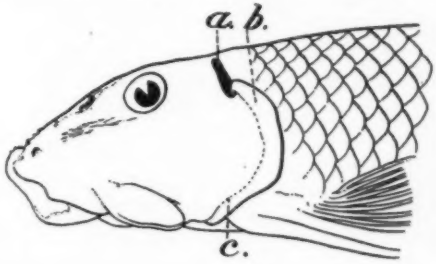


Fig. 2. Lateral view of Head and anterior part of body of *Gyrinocheilus kaznakoi* Berg. *a.* inhalent aperture; *b.* opercular flap of exhalent aperture; *c.* limit of the bony operculum.

divided into an upper slit-like portion, which serves as an inhalent opening and communicates with the posterior part of the mouth cavity immediately in front of the gills; and a lower much wider portion which serves as an exhalent aperture and is guarded by membranous structures. Vaillant,‡

* Hora, S. L. Observations on the Fauna of Certain Torrential Streams in the Khasi Hills. *Rec. Ind. Mus*, **25**, 591, 1923.

* Hora, S. L. Biological Notes on a Fish from Brazil in the Society's Aquarium. *Proc. Zool. Soc., London*, **205**, 1932.

† Hora, S. L. Ecology, Bionomics and Evolution of the Torrential Fauna. *Phil. Trans. Roy. Soc., London*, Ser. B. **218**, 258, 1930.

‡ Vaillant, L. L. Résultats Zoologiques de l'expédition scientifique néerlandaise au Bornéo central. Poissons. *Notes Leiden Mus.*, **24**, 108 (1902).

the author of the genus *Gyrinocheilus*, atributed the respiratory movements of this fish to the expansion and contraction of the walls of the oral cavity, but Smith* has recently observed the vigorous movements of the opercular-flaps—230 per minute. I believe that in *Gyrinocheilus*, as in the other hill-stream fishes referred to above, the respiratory current is initiated and carried on by the opercular-flaps of the exhalent openings.

The above is an instructive illustration of the influence of habit in the production of new forms. The habit of lying close to the substratum and of adhering to rocks by means of lips in hill-stream fishes has ultimately resulted in the modification of the entire respiratory mechanism.

SUNDER LAL HORA.

Zoological Survey of India,
Indian Museum, Calcutta,
July 12, 1932.

The Probable Cause of Cotton Root Rot in Gujerath.

THE Gujerath Root Rot of Cotton has been a mysterious disease so far. In last August when a laboratory was supplied to the Department of Agriculture here, it was possible to find out the nature of this disease. On putting the attacked roots under a moist chamber, the sclerotia swelled and produced pycnidia, in which elongated unicellular spores were formed. These resembled *Phoma* and the writer was under the impression that it was a *Phoma*. On consulting the literature, however, it was found to be a species of *Macrophomina*. Mr. Sunderraman of Coimbatore lately attributes a disease of cotton on that side to *Macrophomina phaseoli*. Whether these both are identical remains yet to be seen. Perhaps it may be a different species altogether or a physiological form. The causal agent was so long known erroneously under the name of *Rhizoctonia bataticola* which name is now replaced by *Macrophomina* sp. The latter nomenclature is accepted even in the Cultural List of Baarn (Holland).

V. N. LIKHITE.

Research Laboratory,
Agricultural Experimental Station,
Baroda,
July 5, 1932.

* Smith, H. M. Notes on Siamese Fishes. *Journ. Siam. Soc. Nat. Hist. Suppl.*, **8**, 187 (1931).

Investigations on Rice in Assam.

RICE investigations in Assam are mainly devoted to pure line selection and hybridization at the Government rice stations at Karimganj and Titabar. The classes of rice that are being dealt with are *aus* or *ahu* (summer and autumn rice), *sail* or *sali* (winter rice), and *asra* (shallow-water *aman*), which is grown only in the Surma Valley. Experiments on *aman* (deep water rice) and *boro* (spring rice) have not yet been tried.

Pure line selection.—The work on pure line selection has been continued for the last fourteen years at Karimganj and for six years at the Titabar station. There are altogether over 2,000 types isolated as pure from about 600 samples collected from different localities of Assam as well as outside. To compare high yielding varieties the "Latin Square method" is adopted in $10' \times 10'$ plots replicated in twelve to twenty-four times or more. The results are tabulated and statistical methods employed for the computation of mathematical constants to express the features of the types under comparison in comprehensible terms. As a result of successful selection, eighteen high-yielding types have up-to-date been recommended from Karimganj station and six types from the Titabar station, which are being grown in various parts of the plain districts of Assam with more or less success in one locality or the other.

Hybridization.—The work on hybridization is being continued for the last eleven years at Karimganj and five years at Titabar station. The characters of rice have been studied in detail in reference to the following :—

(1) Colour character in different parts of the rice plant such as leaf-sheath, pulvinus,

ligule, auricle, internode, outer glume, inner glume, tip, stigma and kernel.

(2) Vegetative character—

(*a*) Awn (long *vs.* short).
(*b*) Outer glume (long *vs.* short).
(*c*) Size and shape of unhusked grains (large *vs.* small and long *vs.* short).
(*d*) Glutinous endosperm (glutinous *vs.* non-glutinous).
(*e*) Panicle (dense *vs.* lax and long *vs.* short).
(*f*) Clustering of spikelets (single *vs.* clustering).
(*g*) Double kernel (single *vs.* double).
(*h*) Straw (tall *vs.* dwarf and strong *vs.* weak).
(*i*) Flowering (early *vs.* late).

Apart from the above, a few interspecific crosses have also been tried. It is with a view to study the above characters and, if possible, to combine desirable traits, apparently inherent in individual types, that a large number of crosses were made, their genetic data for successive generations studied, and "goodness of fit" calculated in each case. As a result of successful selection two hybrids, *viz.*, Karimganj$_1$ and Karimganj$_2$ have already proved successful in cultivators' field and there are four hybrids giving promising results under comparison.

S. K. MITRA.

Jorhat,
July 7, 1932.

Vibrations of Different Parts of the Piano-Forte Sound-Board.

IN my previous paper,* I described the vibrations of the Piano-forte sound-board in general and derived a certain number of conclusions from the analysis of the vibration-curves which were photographed by the electro-magnetic method described in the same paper. Now the author has studied the vibrations of different parts of the Piano-forte sound-board and brought into light the following facts :—

1. The nature of all the vibration-curves of the different parts of the Piano-forte sound-board, for the same key of the keyboard, is the same but their amplitude varies.

2. That the greater the length of the rib, the greater is the amplitude of the fundamental vibration of the rib.

3. That the harmonics which are prominent in one curve are also prominent in the others, *i.e.*, the vibrations of all the ribs are exactly similar.

4. That when the ribs of smaller length are set into vibration, they do not produce higher harmonics of prominent amplitude and thus the higher harmonics become less and less prominent in vibrations of the points lying on the smaller ribs.

5. That the greater the length of the rib, the greater is the amplitude of the harmonics. Hence to produce more harmonics of higher pitch the ribs of larger length are used. That is why, in order to increase the length of the ribs for a certain sounding-board, the ribs are attached to the sound-board diagonally and not vertically or parallel to the foot of the Piano-forte.

6. That all the ribs are vibrating with the same frequency, and the maxima which are present in the vibration of one curve are the same in the case of others. Hence the sound-board vibrates as a whole in one piece round the ribs though it consists of good many pieces of seasoned wood attached to one another and though the ribs divide the sound-board into different fields.

In addition to arriving at the above conclusions the previous method of photographing the vibrations of the sound-board, is also improved a little. The details of the above will soon appear in the *Indian Journal of Physics*.

L. D. MAHAJAN.

Physics Laboratory,
Mohindra College, Patiala (India),
July 4, 1932.

* L. D. Mahajan, "Vibrations of the Piano-forte Sound-board," *Indian Journal of Physics*, **4**, 515.

Relation Between Charge and Viscosity of Colloidal Solutions.

THE results of viscosity measurements of colloids in the presence of electrolytes are generally explained on the basis that viscosity is related to the charge on the

colloid and that smaller the charge on the colloid greater will be its viscosity. The results of the viscosity measurements of colloids with the progress of dialysis are also explained on the basis of the same view. Very few simultaneous measurements of charge and viscosity have, however, been carried out to test the validity of this view. In our laboratory we are making simultaneous measurements of charge and viscosity of various colloidal solutions, dialysed to different extents, in the presence and absence of electrolytes. The purpose of this note is to give a summary of the results of some measurements made by Mr. A. K. Desai in our laboratory on colloidal thorium hydroxide with the progress of dialysis (freeing the colloidal solution from hydrochloric acid and thorium chloride introduced during peptisation).

The charge has been measured by Mukherjee's improved method. The dialysate with suitable additions of hydrochloric acid was found to be very convenient as an upper liquid for charge measurements; the difference between direct and reverse readings generally never exceeded 5 per cent. Thorium hydroxide being a colourless sol, the movement of the boundary was followed with the help of a parallel beam of light. The viscosity was measured with an ordinary Ostwald viscometer.

The results show that with the progress of dialysis although the charge on colloidal thorium hydroxide first increases and then decreases, the viscosity continuously increases. This would mean that charge and viscosity are not related with each other upto a certain stage of dialysis of the sol.

With the progress of dialysis, as the sol is freed more and more from the electrolytes, initially present, one would expect a continuous decrease in the viscosity, the decrease in viscosity being more marked in the beginning than in the later stages of dialysis. The electro-viscous effect will produce a continuous decrease in the viscosity during the period when the charge on the colloid increases with the progress of dialysis. Both these effects, *viz.*, decrease in the electrolyte content and intital increase in the charge with the progress of dialysis, should have decreased the viscosity in the intitial stages of dialysis rather than increase it as in the measurements discussed here. The water content of the colloid particles considerably affects the viscosity of sols, particularly of the lyophillic sols. It is well known that sols like ceric hydroxide which are not markedly electrocratic set *en bloc* to a gel in the dialyser when subjected to extreme dialysis, even without addition of electrolytes and this is mainly due to the fact that the water content or the hydration of particles increases with the progress of dialysis. Hydration will increase the "active volume" and therefore viscosity will continuously increase with the progress of dialysis even in the initial stages of dialysis. An initial increase in viscosity with the progress of dialysis will also occur in the case of thorium hydroxide which resembles ferric hydroxide and aluminium hydroxide which are closer to the hydrophillic sols as regards their viscosity. Our experiments with electrocratic sols—gold sol and others—are expected to elucidate further the nature of this hydration effect. There are yet other effects, *viz.*, the shape and structure of the particles which may vary with the progress of dialysis and may also to a certain extent be responsible for an initial increase in viscosity in spite of an increase of charge. As for the variation in the shape of the particles of thorium hydroxide when it is subjected to dialysis very little is known. The structure of the particles seems to be changing on dialysing in the case of colloidal thorium hydroxide as the sol becomes more and more opalescent with the progress of dialysis. The increase in the opalescence during dialysis is probably due to an aggregation of colloid particles and this aggregation will increase the viscosity as during coagulation.

It will be seen from the foregoing considerations that it is not safe to draw conclusions about the charge on colloid particles with the help of viscosity and such other data, *e.g.*, flocculation values which show a similar behaviour—continuous decrease in the flocculation values of thorium hydroxide with KCl when the colloid is

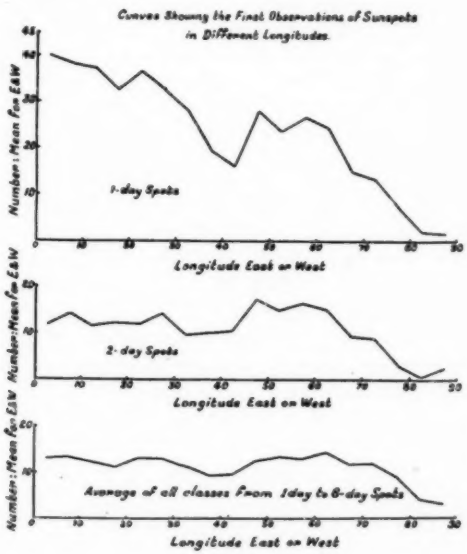
subjected to dialysis, although in some cases they may afford a correct criterion for the same.

B. N. DESAI.

Physical Chemistry Laboratory,
Wilson College, Bombay 7,
July 22, 1932.

Two Longitudinal Zones of Apparent Inhibition of Sunspots on the Solar Disc.

THE nature of the distribution of sunspots in latitude is well known, but no one has hitherto examined their distribution in longitude. This is obviously due to the expectation that there would be no peculiarity in such distribution on a rotating globe like the sun, where sunspots have equal chances of occurring in all longitudes. I had, however, the curiosity to analyse the Kodaikanal records of 20 years from 1909 to 1928, with a view to examining the first occurrence of sunspots of different durations in the different longitudes of the sun. The investigation has revealed the remarkable



and unsuspected fact of the existence of two zones of comparatively lower sunspot frequency between 30° and 50° of longitude east and west of the sun's central meridian. Confirmation of the result has also been obtained by an examination of the Greenwich Photohelio Results which cover a larger number of years. The accompanying curves show the positions of the zones between the sun's central meridan and the limb as revealed by the Kodaikanal Records. It is significant that these two zones occupy a permanent position with respect to the central meridian whose position on the sun is, as is obvious, relative to that of the earth. The details of the investigation will appear in a bulletin of the Kodiakanal Observatory.

P. R. CHIDAMBARA IYER.

Kodaikanal Observatory,
July 22, 1932.

Further Notes on Ariyalur Fossils.

THE mammalian fossils recently obtained from Ariyalur very strongly resemble and possibly most of them are identical with the Upper Siwalik fauna which belong to the Pliocene Age. The occurrence in the neighbourhood of Trichinopoly of teeth, vertebræ and limb bones of Hyæna, Bos, Sus, Rhinoceros, Equus and portions of antlers of Cervus and Bucapra included in our collection will materially support the view, we venture to put forward for the first time that portions of Cuddalore rocks overlying the cretaceous deposits of Peninsular India, must belong to Pliocene system, homotaxial with the Upper Siwaliks. Our future investigations will be devoted to collect more evidence in favour of the thesis we propound here. It is well known that at about the time when the fauna of Siwalik province attained its greatest profusion, a general movement of the various families commenced which culminated in a general migration towards the south at about the close of the Pleistocene times. The evidence derived from certain faunistic peculiarities of the hills and mountains of South India points to this conclusion and when, towards the close of the Tertiary age the Siwalik fauna was destroyed by the glacial climate, dampness of atmosphere, especially in the plains of India, some of the migrants to the south might have secured a habitat

less affected by atmospheric changes and possibly survived the general cataclysms which overtook their northern congeners.

Plate I.
Horn showing bur of a deer.

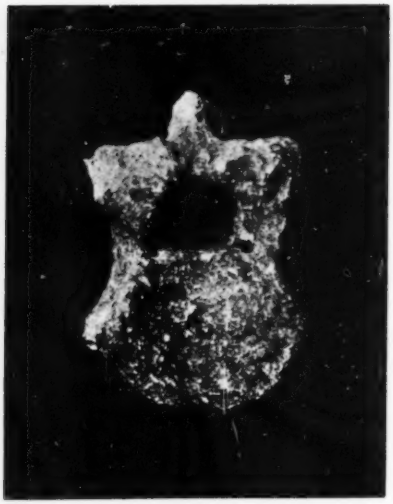


Plate II.
Cervical Vertebra of a Ruminant, possibility of Bos.

We hope to be able to revert to the subject soon with more evidence than we are able to put forward at present and reproduce here photographs of two fossils from our collection which is fairly rich. These are proposed to be dealt with in detail separately.

B. R. SESHACHAR.
A. NARAYANA RAO.
L. S. RAMASWAMI.

University of Mysore,
Department of Zoology,
Bangalore,
July, 1932.

Occurrence of the Tracheids in the Gametophyte of *Adiantum lunulatum* Burm.

LANG has described tracheids in the apogamous gametophytes of a few species of ferns.* So far as the knowledge of the writer goes, nobody else has described the presence of tracheids in the fern gametophyte. The writer has come across stray patches of tracheids in the body of the gametophyte of the fern *Adiantum lunulatum* Burm. Pure cultures of the gametophyte of the species were raised from the spores, which were sent by Ratna Bahadur Pradhan from Sikkim. The spores were sown on sterilized soil in pots which were covered over with glass plates to avoid contamination. The cultures were placed in a glass house with cultures of other species, all of which were watered from below.

The well-developed prothalli of *Adiantum lunulatum* show tracheids in the region just anterior to the cushion behind the apical notch. The cells at this place are very much elongated even if they are not thickened in the manner of the tracheids. The latter usually form clusters of 2—4 elements. In the prothalli which have either developed two anterior growing points or where the normal growing point has become shifted to one side, another patch of tracheids may develop in the tissue posterior to the growing region. Two or sometimes three groups of tracheids which remain usually isolated from one another have been observed in a single prothallus.

The antheridia of the species are of the

* *Phil. Trans.*, **190**, 1898.

usual leptosporangiate type and produce apparently functional motile sperms. The archegonia, however, are completely absent and have not been seen. The sporophyte arises apogamously as a bud from the gametophyte. The tracheidal mass formed in the interior of the apogamous bud may be connected with the tracheids of the prothallus but more often it remains quite isolated.

The gametophytes of *Pteris biaurita* Linn. and *Anisogonium esculentum* Presl. kept alongside the cultures of *A. lunulatum* showed no development of tracheids. The former resembles *A. lunulatum* in the complete absence of archegonia and the development of embryo by means of an apogamous bud. *Anisogonium esculentum*, however, has a normal prothallus.

It seems that the development of tracheids in the gametophyte of *Adiantum lunulatum* is not due to the effect of external conditions but depends probably on internal causes. Further cultural and cytological investigations are in progress.

P. N. MEHRA.

Lahore,
July 11, 1932.

A Short Note on the Structure and Development of *Petalophyllum indicum* Kash.

THE species was found for the first time by the writer in November 1925 and a brief systematic description was given by Prof. Kashyap in the *Journal of the Indian Botanical Society*.* The writer has worked out pretty fully the structure and development of the plant with the exception of earlier stages of the sporophyte. The midrib of the thallus is mycorhizous, the cells containing unseptate hyphæ. Enlargements of the hyphæ resembling oogonia have also been found in certain cells. Growth takes place by means of a three-sided pyramidal apical cell giving off two lateral and one ventral series of segments. The growing point is protected by 3-5-celled mucilage hairs and a few triangular scales.

The plants are diœcious. The scales which protect the antheridia become occasionally fused near the apex to form definite chambers in which the antheridia lie. The development conforms to the usual type of the Jungermaniales. A row of three cells is formed before the formation of a vertical wall. In one case a row of four cells was present without any vertical wall whatsoever.

The development of archegonium follows the usual Jungermaniales type. A few abnormal archegonia have been seen; in one case there were two eggs in the venter, in another the ventral canal cells were multinucleate. A careful investigation of the perianth proves it to be similar to the perianth of *Sewardiella tuberifera* described by Prof. Kashyap.* In the course of its development, there are free bracts in the early stages which are carried up by basal zonal growth to form the usual bell-shaped perianth. A few bracts are found attached to the inner and the outer surface of the perianth and a few are sometimes met with quite free inside the involucre near the base of the seta.

B. R. VASISHT.

Lahore,
July 11, 1932.

* *Jour. of the Ind. Bot. Soc.*, **6**, 14, 1918.

Chromosome Number in Pyrgomorphinæ (Acrididæ).

THE chromosome number in the males of the majority of Acrididæ (Acridinæ, Oedipodinæ and Tryxalinæ) has been established to be 23 including 11 euchromosomes and a single X-chromosome. A few occasional variations occur but are of a nature not to invalidate the numerical constancy in the group. But in the subfamily Pyrgomorphinæ, as alluded to by McClung casually in a foot-note to his paper on the Synopsis of Mecostethus,† the chromosome numbers exhibit definite departure from the above rule. The writer has been engaged for some time past on a comprehensive study of the chromosome behaviour in the male germ cells of Pyrgomorphinæ and preliminary to the preparation

* *New Phytologist*, **14**, 1915.
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less affected by atmospheric changes and possibly survived the general cataclysms which overtook their northern congeners.

Plate I.
Horn showing bur of a deer.

Plate II.
Cervical Vertebra of a Ruminant, possibility of Bos.

We hope to be able to revert to the subject soon with more evidence than we are able to put forward at present and reproduce here photographs of two fossils from our collection which is fairly rich. These are proposed to be dealt with in detail separately.

B. R. SESHACHAR.
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University of Mysore,
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July, 1932.

Occurrence of the Tracheids in the Gametophyte of *Adiantum lunulatum* Burm.

LANG has described tracheids in the apogamous gametophytes of a few species of ferns.* So far as the knowledge of the writer goes, nobody else has described the presence of tracheids in the fern gametophyte. The writer has come across stray patches of tracheids in the body of the gametophyte of the fern *Adiantum lunulatum* Burm. Pure cultures of the gametophyte of the species were raised from the spores, which were sent by Ratna Bahadur Pradhan from Sikkim. The spores were sown on sterilized soil in pots which were covered over with glass plates to avoid contamination. The cultures were placed in a glass house with cultures of other species, all of which were watered from below.

The well-developed prothalli of *Adiantum lunulatum* show tracheids in the region just anterior to the cushion behind the apical notch. The cells at this place are very much elongated even if they are not thickened in the manner of the tracheids. The latter usually form clusters of 2—4 elements. In the prothalli which have either developed two anterior growing points or where the normal growing point has become shifted to one side, another patch of tracheids may develop in the tissue posterior to the growing region. Two or sometimes three groups of tracheids which remain usually isolated from one another have been observed in a single prothallus.

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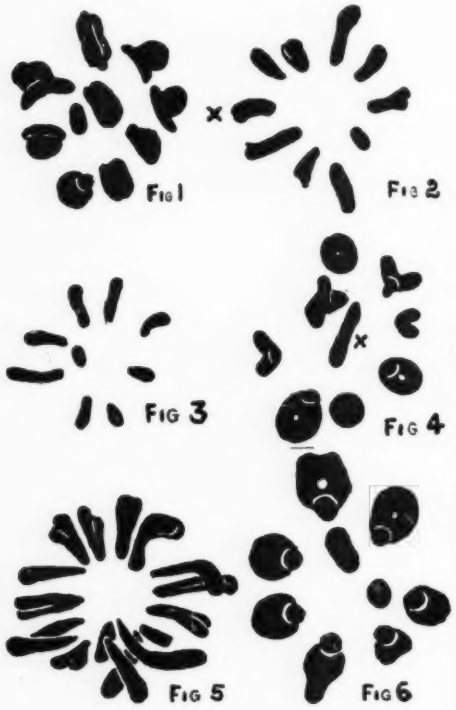
of a detailed account he desires to record in these columns the chromosome numbers of three genera of the group.



Colemania sphenoroides Bol. exhibits 19 telomitic rod-shaped chromosomes in the spermatogonial complex showing a gradual seriation in size. During the first spermatocyte metaphase they resolve themselves into 9 ring-shaped tetrads and the X-element (Fig. 1). Fig 2 shows one group of second spermatocyte metaphase containing the X-chromosome. In *Aularches miliares Linn.* and *Chrotogonus* sp., however, the diploid number is 17—all telomitic. While in *Aularches* the first spermatocyte contains 8 ringed terads and the X-element (Fig. 6), in *Chrotogonus* there are five rings and 3 V-shaped tetrads beside the X-element (Fig. 4). Fig. 3 is a second spermatocyte metaphase plate of *Chrotogonus* and Fig. 5 the spermatogonial metaphase plate of *Aularches*. Similar studies of a number of other Pyrgomorphines are in progress.

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July 29, 1932.

The First Spark Spectrum of Arsenic.

IN a recent communication by the writer,* the chief triplet and singlet terms of AsII, due to the configurations $4s^24p^2$, $4p5s$ and the ^3D and ^1D terms of 4p 4d, were identified and reported. With a view to extend the analysis into the visible and the near infra-red regions, the spectrum of the discharge through pure arsenic vapour, contained in capillary tubes, has been photographed with a glass littrow spectrograph, using varying intensities of discharge. With our knowledge of the intervals of the $5s^3P$ terms ($5s^3P_1 - 5s^3P_2 = 2380$ cm^{-1} and $5s^3P_0 - 5s^3P_1 = 397$ cm^{-1}) and with the aid of these recent experiments it has been possible to establish the chief triplet terms due to the 4p 5p configuration. These are shown in Table below.

There are still some strong and diffuse groups of lines in the visible and the quartz regions which have to be ascribed to the singly-ionised atom of arsenic. It was suggested in the previous paper that these diffuse groups of lines might be due to the transition $4d \rightarrow 4f$, of the series electron, giving rise to multiplets of the type $^3D^3F$, $^3F^3G$, $^3D^3D$, etc. Since the previous work was completed, the $4d^3F$ and the $4d^3P$ terms have been identified. A knowledge of the intervals of the $4d^3D$ and the $4d^3F$ terms has led to the assignment of these groups of lines as being due to the combinations $4d^3D - 4f^3F$, $4d^3D - 4f^3D$ and $4d^3F - 4f^3G$. Besides these, the ^3P and the ^3D terms due to the configuration $4s\,4p^3$ have been discovered. The $4p^3\ ^3D$ terms are found to give strong combinations with the $5p^3D$ and the $5p^3P$ terms.

The hyperfine structure of some of the important lines between 6000A and 4000A

*Proc. Phys. Soc., **44**, 243, 343.

	$5p\ ^3D_1$ 65876	$5p\ ^3D_2$ 65676	$5p\ ^3D_3$ 63592	$5p\ ^3P_0$ 64553	$5p\ ^3P_1$ 63610	$5p\ ^3P_2$ 62530
	200.2	*2083.6*		*942.5*	*1079.6*	
$5s\ ^3P_0$ 84059 *397*	18183.4 (10)				20449.4 (8)	
$^3P_1$ 83662 *2381*	17786.0 (5)	17986.0 (10)		19109.6 (8)	20052.1 (9)	21131.7 (10)
$^3P_2$ 81281	15406.0 (4)	15606.2 (4)	17689.3 (10)		17671.6 (8)	18751.3 (10)
$5s\ ^1P_1$ 79972					16360.3 (10)	17441.2 (6)

has been studied using Lummer plates and etalons. Although it is found that the classification of the lines given by Tolonsky is not correct, the value of 3/2 for the nuclear spin moment is confirmed (Tolonsky, *Nature*, **129**, No. 3261, 652).

Details of the work will be published elsewhere.

A. S. RAO.

Solar Physics Observatory,
Kodaikanal,
July 22, 1932.

Research Notes.

Adsorption of Gases.

AT the general discussion on adsorption of gases held by the Faraday Society, emphasis was laid on two types of adsorption, activated adsorption and adsorption of the Van der Waals type. Activitated adsorption or "Chemi-adsorption" takes place at high temperatures and the heat associated with it is roughly ten times that developed during the Van der Waals type adsorption which is a low temperature phenomenon.

The importance of the work of Volmer and his school on the mobility of adsorbed molecules, the promising use of thermionics in adsorption problems, the discontinuous nature of adsorption curves were other features brought out during the discussion. Special mention may also be made of the theory of Lennard Jones which satisfactorily explains a number of adsorption phenomena.

Disintegration of Elements.

COCKCROFT and Walton have recently described their experiments (*P.R.S.*, **137**, 229, 1932) showing that protons of energy over 150,000 volts are capable of disintegrating many elements.

Positive ions from a hyrdogen canal ray tube, falling through voltages upto 600 kilovolts, hit a target of the element to be investigated. The source of error due to the emission of the secondary electrons, which have energies below 20 volts, is eliminated by applying a magnetic field of about 700 gauss to the target. The secondary radiation for Lithium is shown to consist of particles with a range of about 8 cms. This range does not alter by varying the accelerating voltage between 250 and 500 kilovolts. By the use of the Shimizu expansion chamber and Williams-Ward ionization-chamber method, these particles have been identified as α-particles, produced by the disintegration of Li_7, into two α-particles under proton bombardment :

$$Li_7 + H_1 = 2He_4$$

The decrease of mass in the disintegration corresponds to an energy liberation of $(14.3 \pm 2.7) \times 10^6$ volts, which is in agreement with the observed energies of the α-particles. The probability of the proton penetrating a lithium nucleus according to Gamow's theory (*Zs. f. Phys.*, **52**, 510, 1928) is higher than their observed value. The authors are attempting to improve their experimental technique.

Lithium, Boron and Fluorine yield the largest emission of α-particles and they are all of the $(4n+3)$ type containing perhaps nuclei of α-particles with the addition of three protons and two electrons. Certain other elements have been disintegrated and the results will be clear from the following reactions :—

$$Na_{23} + H_1 = Ne_{20} + He_4$$
$$K_{39} + H_1 = A_{36} + He_4$$

The Relation of the Duodenal Mucosa to the Internal Secretion of the Pancreas.

LAUGHTON and Macallum (*P.R.S.*, Ser. B., **3**, No. 769, 1932) have succeeded in the separation of an active principle from the duodenal mucosa of rabbits, dogs, hogs and cattle which in its physiological properties differs from secretin and insulin. In the experiments conducted by them, they establish that this new substance has no effect on the external secretion of pancreas, but has a hypoglycæmic effect different, however, from insulin. It has practically no effect on the blood sugar when injected into the totally depancreatised dog, but manifests a decided influence in reducing the sugar of a partially depancreatised dog in which hypoglycæmia is experimentally induced, causing the blood to return rapidly to the normal level. It has no hypoglycæmic effect, like insulin in normal animals. It is assumed that this preparation stimulates the islets of Langerhans to secrete insulin. The paper discusses the probability that this substance is in the nature of an insular harmone whose physiological effect on the internal secretion of pancreas takes us a step forward in the control and treatment of diabetes mellitus.

The Absolute Measurement of High Electrical Pressures.

IN a paper in the *Journal of the Inst. of Electrical Engineers*, Prof. W. M. Thornton and W. G. Thompson describe a method in which the polarization of a metallic Ellipsoid of Revolution, suspended by an insulating fibre between vertical circular pole plates is used to measure high electrical voltages up to 200,000 volts. The measurements of voltages by this method have been compared with sphere gap determination of voltage. Continuous measurements of voltages upto 200,000 volts can be made with the precautions indicated in the paper to an accuracy of at least 3 parts in 1,000.

Absorption of Water by Root System of Plants.

[Paul J. Kramer. *Amer. Jour. Bot.*, **39**, 148, 1932.]

FROM earliest days of Plant Physiology, workers have taxed their ingenuity to explain the absorption of water and of root pressure in Plants. The various theories put forth from 1832 to 1930 bearing on the problem vary widely in the importance attached to activity of the living cells of the root. However, they fall under two lines, either the living cells of the roots play the important part, or the physical forces concerned operate independent of the living cells. The experiments conducted and described by the author throw further light on the actual rôle of the living cells of the roots. Under conditions of reduced transpiration the water absorbed moves from the soil to the conducting vessels by osmosis across the differentially permeable multicellular membrane—the living cortex of the root—and accumulation of the water in the vessel developing a positive root pressure. Such positive pressures were manifested at the cut ends of stems, only when the roots were alive. Tips of plants with dead root system, remained alive for several days. Plants with root systems killed and suction applied at the cut end of the stem absorbed water for a few days as though the root system was alive. The rôle of the living cells of the roots in such

absorption processes is apparently a passive one. They are important as absorbing surfaces in preventing the entry of air into the vessels, and in extending the area of absorption by growth.

The Gondwana System.

THE recent memoir (Vol. LVIII) by Dr. C. S. Fox on "The Gondwana System and related formations" forms one of a series of four memoirs dealing with "Coal in India" proposed to be published by the Geological Survey of India. The present memoir is a summary of all the available information on the Gondwana system, brought up-to-date as far as possible, so as to include the results of the most recent work on some aspects of this subject by eminent palæontologists like Dr. Cowper Reed and Prof. A. C. Seward. There is a thorough discussion of the problem of the classification of the Gondwana system, and a revised classification, which may be considered satisfactory in the present state of our knowledge, is suggested in a tabular form (Plate 9) accompanying the memoir. The author has also referred to the palæo-geography and climate of the Gondwana land, and has endeavoured to depict the changes in the distribution of land and water in India during the Gondwana era by a series of four maps. The author is of opinion that considering the great lapse of time—150 million years—the geographical changes during the Gondwana era are remarkably small and that the general distribution of land and sea, according to present-day conceptions, was relatively constant throughout the period.

Neutrons in the Atmosphere.

IN a letter to *Nature* (**130,** 57, 1932) Moon, in an attempt at evaluating the neutronic concentration in the atmosphere shows that the presence of neutrons brings about an *apparent* decrease of the Newtonian gravitational constant with increase of temperature. Combining the experimental results of Shaw (*Phil. Trans.*, **216,** 349, 1916) with his own approximate formula for the partial pressure of neutrons in the atmosphere, he finds that with the neutronic data available at present the partial pressure is of the order of 10^{-6} atm.

Periodic Failures and the Punjab American Cotton Crop.

IN some years the Punjab American Cotton Crop has been afflicted with an unknown disease, the damage caused by which exceeded 5 million pounds sterling. It was fairly general over the Punjab Province in 1919, 1921, 1926, 1927 and 1928. Roger Thomas ("Periodic Failures of the Punjab American Cotton Crop," *Agriculture and Live Stock in India*, Vol. 2, Part 3, May 1932) from his investigations is of the opinion that the basic cause of these crop-failures in the Punjab is the cotton white fly (*Bamisa gossypiperda*).

The paper describes the distribution and life history of this pest. Comparisons of the damage done by this pest in cage experiments and the symptoms of the disease are outlined. The intensity of the white fly in any year is believed to be largely controlled by rainfall during the months of May to August and also by predators and parasites.

This explanation of the cause of the failure of cotton crop is not generally accepted by cotton research workers in India or by the Punjab Agricultural Department.

The author describes economic and practical methods of controlling the white fly, which he has applied on a commercial scale in the plantations of the British Cotton Growing Association. The method includes: (*a*) spraying the crop during the months of July and August with rosin-soda compound, (*b*) manuring the crop at flowering stage (end of August or early September) with a light dose of nitrogenous manure, (*c*) delay the sowing until late in May or early in June, and (*d*) breeding strains relatively immune to white fly attack.

Laboratory Lightning Doubled in Voltage.

(*Electrical World, June* 18, 1932.)

AT the Pittsfield Works Laboratory of the General Electric Company 10,000,000 volts

have been artificially produced by the Lightning generator designed by Mr. F. W. Peek, Jr. This lightning forms a 60 ft. arc and has a capacity of 50,000,000 KW. discharged in one microsecond across a sphere gap. The maximum current delivered during discharge after the resistance of the air has been broken down is 50,000 Amps.

In 1929 artificial lightning discharges of 5,000,000 volts were attained at Pittsfield. Similarly 1,000,000 volt, 60 cycle, 3 phase arcs were produced.

Locomotor Organs of Echinarechinus parma.

[Parker George H. and Margaret Van Alstyne. *Biol. Bull.*, **62**, 195, 1932.]

THE method of locomotion in Echinarechinus Parma is described for the first time. Of the three classes of organs, integumentary cilia, tube-feet and spines suspected of having to do with locomotion, integumentary cilia do not play any significant part in the process as they cover only the tips of the short spines and the sides of the long ones. The tube feet which are provided with suckers are important in locomotion only to a limited extent in that they pile up sand on the aboral surface. Spines, which are of two types, short and long, are best developed over the anterior portion of the oral surface. Waves of coordinated spine movement enable the animal in forward locomotion, burrowing and righting.

Radiations Excited by α-Rays in Light Bodies.

IN *Comptes Rendus*, **194**, 2208, 1932, Mme Irene Curie, M. F. Joliot and M. P. Savel describe experiments in which beryllium and lithium were bombarded with α-rays and the properties of the emitted neutrons were studied. This was accomplished by making the neutrons pass through paraffin and determining the range of the H-rays produced. When the neutrons were emitted forwards, *i.e.*, in the direction of the incident α-rays two different groups of H-rays were observed, having respectively the ranges 43 and 110 mg./cm.^{2} of Al which correspond to 28 and 70 cm. in air. The more penetrating H-rays were not observed when paraffin was replaced by carbon. From the presence of the two groups of H-rays, the authors infer the production of two groups of neutrons having the velocities 2.94×10^9 and 3.84×10^9 cm/-sec. *i.e.*, having energy equal to 4.52×10^6 and 7.8×10^6 eV respectively. These results are represented by the reactions:

$$Be_9+\alpha\rightarrow C_{12}+n\uparrow+\gamma$$

and $$Be_9+\alpha\rightarrow C_{12}+n\uparrow$$

In the first case the neutrons had a small velocity but at the same time secondary rays corresponding to γrays of energy between 2 and 4.5×10^6 eV were observed. Hence the conclusion that the liberated energy gives rise to neutrons of large velocity in the second case and to neutrons of smaller velocity together with γ-rays in the first case.

When the neutrons are shot backwards *i.e.*, at angles of 120° to 180° with the direction of the incident α-rays, two groups of H-rays of ranges 26–32 and 7–10 cm. are to be expected, but only one group having a range lying between these limits was observed. The range was 35 mg./cm.^{2} of Al which corresponds to 23 cm. of air. This result is explained by the authors as possibly due to the low accuracy of the measurements in this case. They also think that the presence of a group having the maximum range 40 cm. as found by Chadwick (who obtained two groups corresponding to 22 and 40 cm. whether the neutrons were shot forward or backward) is doubtful in view of the proton absorption curves obtained by the present investigators.

Assuming the above reactions and taking the mass of the neutron as 1.006 (a value deduced from the reaction, $B_{11}+\alpha\rightarrow N_{14}+n\uparrow$ assuming He=4) the mass of Be_9 has been found to be 9.006. From this they conclude that the energy of binding of the α-particles and neutron forming the Be_9 nucleus is very small.

Anatomy and Micro-Chemistry of the Cotton Seed.

[R. G. Reeves and C. C. Valle. *Bot. Gaz.*, **93**, 259, 1932.]

THE Cotton seed once regarded as worthless has taken a prominent place among the agricultural commodities, since the recognition of the uses of cotton seed products. The previous investigators disagree as to the localization of certain chemicals and oils in the seeds, the extraction of which presents various types of problems. The present work was undertaken to get accurate knowledge of some of the debatable problems pertaining to the subject. Young ovules and mature ovules of American upland cotton were studied in addition to Pima and Sea Island cottons. The anatomy of the ovules, layer by layer, has been described and illustrated with sketches. The embryos, both young and old, are found to contain traces of starch in addition to oil. The commonly noticed pentosans occur in the resin glands which contain other substances also. At maturity endosperm cells contain small quantities of starch and an abundance of protein and oil; the perisperm is referred to by Winton as the remaining epidermis of the nucellus. The integuments are free from starch before maturity. The pigmentation of the cells of the palisade and epidermal layers is associated with a hardening protoplasm. The palisade layer is part of the inner integument and contains cellulose and lignocellulose.

Urease Content of Leguminous Seeds.

SOYA bean and Jack bean have been extensively employed as sources of urease, but the possibility of the existence of richer sources of the enzyme has not so far been explored. With this object in view, Sundara Iyengar and Sastri have examined more than thirty commonly occuring leguminous seeds belonging to different suborders and have arrived at certain interesting conclusions. Among the seeds examined, *Pongamia glabra* showed the highest urease activity; *Dolichos biflorus* and *Cajanus indicus* came next. Narayana Menon and Narayana Rao (*Ind. J. Med. Res.*, **19**, 1077, 1932) have, independently of this work, shown that *Dolichos biflorus* is as rich a source of the enzyme as Soya bean. *Pongamia glabra* thus constitutes one of the richest sources of urease.

Twinning in Plagioclase Felspars.

THE two papers on the application of Federov methods for the study of the twinning of Plagioclase Felspars, recently published by A. L. Coulson (*Rec. Geo. Sur. Ind.*, 65, Pt. 1) are of considerable interest. In the first paper dealing with the zoning and difference in composition of twinned Plagioclase Felspars in certain rocks from Sirohi State, Rajputana, ten instances of the difference in composition of the individuals of twinned Plagioclase Felspars have been described, and it has been pointed out that "the difference in composition between individuals forming a twinning combination is not always evidenced by zoning and this leads one to doubt determinations of composition based solely on observations of the zone perpendicular to the twinning plane." In the second paper dealing with the Albite-Ala B twinning of Plagioclase Felspars in certain acidic rocks from the same area, the author points out, that out of ten twinning combinations measured in the Plagioclase phenocrysts of dellenites and porphyries from one locality, six contained the Albite-Ala B complex; and all the Albite-Ala B complexes had a composition of about 33 per cent An.—which composition appears to be peculiarly favourable for the formation of this complex.

The Structure of Vertebraria.

Vertebraria, like *Glossopteris*, is one of the commonest and most characteristic plant-fossils of the Lower Gondwana (Upper Carboniferous and Permian) rocks of India and the Southern hemisphere. But its structure and affinities have long been a problem. Originally regarded as one of the Equisetales, it was later suspected to be the stem of a fern. The latter view was influenced by the discovery of specimens bearing leaves of the *Glossopteris* type, which were then believed to be fern fronds. More recently the view has gained ground that *Glossopteris*,

and therefore *Vertebraria*, belong to seed-bearing plants. Prof. Walton of Glasgow and Miss J. R. Wilson have recently thrown some light on the structure of *Vertebraria* (*Proc. Roy. Soc. Edin.*, **52** (ii), 8, 200, 1932). With the help of Walton's cellulose peel method it has been shown that the greater part of the axis consisted of secondary wood of the gymnospermous type. The tracheids are provided with multiseriate bordered pits, which may be either opposite or alternate ; the medullary rays are narrow, and in the area common to a medullary ray cell and a tracheid several bordered pits are present. The primary wood and pith (if one was present) appear to have been very poorly developed. In specimens preserved at right angles to the planes of bedding the thin plates of tissue radiating from the centre represent the much-compressed wedges of secondary wood. In the living plant these wedges must have nearly filled the large triangular spaces between them, leaving room only for the medullary rays. The present work thus supports the view that *Vertebraria* belongs to a seed-plant.

A Fossil Dicotyledonous Wood, Devoid of Vessels, from the Rajmahal Hills.

Sahni describes under the name *Homoxylon rajmahalense* gen. et sp. nov. (*Mem. Geol. Surv. Ind., Palæont. Indica, N.S.* **20** (2), 1, 1932) what is no doubt an angiosperm wood of an archaic type. It resembles *Drimys*, *Trochodendron* and other members of the primitive Ranalean plexus in the absence of true vessels, the pitting of the tracheids, the structure of the medullary rays and in other features. The age of the fossil is believed to be Jurassic, but is not known with certainty.

A Comparative Study of the Phosphagens with some Remarks on the Origin of Vertebrates.

[O. M. Needham, J. Needham, E. Baldwin and J. Yudkin, *P.R.S.*, Ser. B. **110**, No. 767, 1932.]

SUBSEQUENT to the discovery of labile phosphorus in muscular tissue by Eggleton and Eggleton (1927), it has been practically assumed that arginine phosphate is characteristic of invertebrates while creatine phosphate is characteristic of *Cephalochorda* and *Vertebrates*. The usual Fiske and Subbason (1929) method with the various modifications thereon have been followed. Practically examples of every group have been experimented upon and it should be noted, however, that *Balanoglossus* and *Echinoderma* contain both the kinds of phosphates, thus affirming Bateson's (1886) view of the affinity between *Echinoderma* and Chordata. Curiously the *Ctenophora* alone exhibit the presence of arginine phosphate in the phylum *Cœlenterata*. Further evidences are put forward to show that the arginine phosphate may be somehow associated with the ciliary movement.

The Industrial Outlook.

Tea Fermentation.

THE essential characteristics of black tea are developed during the fermentation process. The exact nature of the chemical changes involved or even the agency responsible for fermentation is still obscure and until scientific research clarifies the situation, rigid control of the process cannot be hoped for or replace the existing arbitrary standards based on visual and sensory judgments.

A certain degree of insight has, however, been obtained by the work done in several countries. Thus it is known that fermenting leaf requires oxygen, indicating that some component of the leaf is oxidised. The absorption is rapid at first but gradually slows down and the time-oxygen consumption curve is similar to curves representing enzyme action. At the same time carbon dioxide is evolved but the course of respiration is not normal. The free tannin content of the leaf decreases as also the total soluble constituents and starch. Nitrogenous compounds do not appear to take part during the fermentation. Tea tannin is capable of forming red derivatives called phlobaphenes

and these substances which are soluble in aqueous solutions of tanninsimpart the red coppery colour to tea decoctions. Prolonged oxidation leads to the formation of brown oxidation products which make the liquors dull. Aroma is developed during fermentation and this has been traced to the release of an essential oil which, on fractionation, yields an alcohol containing 6 carbon atoms and methyl salicylate. This oil is found exclusively in the leaves. Prolonged fermentation leads to a loss in flavour and Mann in 1907 suggested that this was due to the development of micro-organisms. As a result of the chemical changes, heat is developed during the fermentation and the temperature of the fermenting leaf increases in the early stages but gradually slows off.

There are at least two theories which have been put forward from time to time to elucidate the nature of the causal agency of the fermentation. The earliest was that fermentation was a putrefactive change but this had to be given up when it was shown that oxygen was essential for fermentation. The observation that fermentation was arrested at elevated temperatures—say at about 212° F.—showed that the fermentation was caused by thermolabile agents. The micro-organic theory was put forward by Kozai in 1891 and this was rigorously put to the test by Bosscha and Bozeskowsky who showed in 1916 that normal fermentation did occur with sterilized leaf. The usual sign of over-fermentation—the objectionable odour—did not develop with the sterile leaf even on prolonged fermentation. It was further shown that although the presence of some yeasts did not interfere with the normal course of the process the presence of moulds and bacteria was detrimental to the quality of tea. Oxidases, peroxidases and catalase have been demonstrated in the leaf and fermentation is ascribed to the oxidase group of enzymes. Although there is a general acceptance of this theory there has as yet been no work to show that the addition of the isolated enzyme to fermenting leaf alters the rate of degree of fermentation and until this is done the enzyme theory cannot be accepted without reservation.

Proper insight into the nature of fermentation cannot be obtained by isolated laboratory experiments alone, but such work should be coupled with large-scale factory experiments. Important work is being carried out in this direction in the laboratories of the Tea Research Institute of Ceylon. Thanks to the generous grant from the Empire Marketing Board, small-scale machinery for the manufacture of tea have been provided and it is hoped that with these facilities the nature of this important process in black tea manufacture will be elucidated.

B. N. SASTRI.

New Type Storage Battery Exhibited in France.

(*Electrical World:* June 18, 1932.)

CONSISTING essentially of a centre electrode of carbon surrounded by an absorbent material saturated with zinc iodide and contained in an electrode sheet of metallic zinc, a new type of electric storage battery was announced before the French Academy of Sciences early in June. F. Boissier is the inventor. When the battery is charged, the zinc iodide breaks down into metallic zinc that is deposited on the zinc sheeting and iodine that accumulates on the carbon electrode and in the absorbent material which may be an absorbent carbon powder. The zinc iodide is reformed during the discharge. M. Boissier claims this battery to be superior to the conventional storage batteries of the lead or nickel variety. As the plates do not disintegrate, there is no acid or caustic liquid to spill, no dangerous gases or vapours are given off and continual maintenance is not necessary.

B.K.R.

4-Ton High Frequency Induction Furnace Installed in Chicago.

(*Electrical World:* June 28, 1932.)

A 4-TON Coreless Induction Furnace has been put in operation in the Chicago District, capable of melting 40 to 50 tons per day. This is double the size of any coreless

furnace previously installed, and is disigned to melt low carbon stainless steel scrap, Ferro-alloys, etc. Essentially the furnace is an air transformer whose primary is a single layer helix of water-cooled copper tubing and whose secondary is the metal charge. Power from 1250 KVA—1000 cycle generator induces currents to circulate in the outer part of the charge thereby heating it. No electrodes are used. The charge is stirred by the electrical forces within the bath. Metal can be melted rapidly and with very little wear on the lining.

It is reported that this is probably the first time that the problem of carrying 12,000 Amp. at 1000 cycles or more has been successfully handled.

B.K.R.

Hollow Electrode Furnace reduces Ores to Steel.

BY passing finely divided ores intimately mixed with reducing materials through the hollow electrodes of an electric furnace high grade plain carbon and alloy steels may be produced. Such a furnace reported in the *Electrical World* of June 18, 1932, as a notable advance in steel making has been manufactured by the Buffalo Electric Supply Corporation, Buffalo, N.Y. This type of furnace accomplishes in a single unit the production of a refined and finished product from metalliferous ore. It is said to have an output comparable to even the highest grade electric furnace, though acting in melting, refining and alloying capacities simultaneously with its equivalent blast furnace function.

B.K.R.

Science News.

ACHARYA Sir P. C. Ray, the veteran chemist, completed his seventieth birthday this year. The services of this savant in the cause of Chemistry in India are very well-known. He could easily be described as the father of chemistry in this country, and the Indian Chemical Society, the only organization for Chemists in India, owes its origin and existence to the untiring efforts and munificence of the Acharya. As the founder of the Bengal Chemical and Pharmaceutical Works, he is the pioneer of Indian Chemical Industry. No less are his efforts in the cause of the afflicted and the distressed. His organization for the relief of the flood-stricken in Bengal, time after time, bears testimony to the public activities of the scientist. His work on "The History of Hindu Chemistry" is the only one of its kind. Translated into several languages it represents a great contribution to this interesting subject. He has been responsible for the building up of a school of Chemistry in Bengal, several of whose pupils have achieved great eminence in their fields of study.

At a public meeting of his admirers and students held in Albert Hall, Calcutta, on the 1st. March 1932, it was decided to celebrate the 70th. birthday of the Acharya in a fitting manner. A committee has been constituted to issue a commemoration volume contributed by those who know the Acharya intimately as a master or a public worker. A book of 500 pages is promised next September. We await the publication with keen interest.

* * *

Dr. Zia-ud-din Ahmad, M.L.A., addressing the members of the University Union, Bangalore, on the 19th. July discussed the limits of error in marking the examination papers, arising from causes such as the difference of perception of excellence, personal idiosyncracies of examiners, difference of standard of awarding marks adopted by them, their fatigue and their speed of valuing. He pointed out that the total deviation due to all these sources of error, when mathematically deduced, would amount 7.5 per cent in an examination in one subject, in which there are two papers of 50 marks each. He also dwelt on the theory underlying the practice of gracing up the marks of candidates failing to obtain the minimum for a pass, and as the result of statistical investigations, it is found that in case a candidate is required to obtain 33 per cent., in an examination comprising four subjects, each consisting of two papers carrying 50 marks, the true mark of the candidate may be anything between 28—38. After reviewing the other aspects of examination, such as the deviation in the average marks of any two examiners, the determination of the order of merit, and so forth, he was led to the view that the element of chance plays an important rôle even in the best conducted examinations.

All this philosophy apart, the man in the street would like to know how far the examination marks represent the true and complete picture of the normal state of the candidates' mind, its power, range and flexibility.

* * *

The annual convocation of the Dacca University took place on the 28th. July when the address was delivered by Sir C. V. Raman. He chose for the subject of his address "Science and Human Life". He complimented Dacca on her happy environments and Bengal on having as the Chancellor of her two Universities, one whose early interest had been in the field of science.

Speaking about the relations between science and human life, he suggested that a false sense of values underlay the common belief that science was justified by its power to create wealth and new comforts or conveniences for humanity. Science was equally capable of furnishing methods for the destruction of wealth and of multiplying human misery and suffering. The true justification of science lay in its success in opening out a new vision of the universe, in giving us an insight into the origin and development of human life, in fact, in its enabling man to perceive himself in his proper relation to the universe he lived in. The progress of the human race would depend on the success attained in applying the methods of science to the study and control of human activities in all their varieties. Science was creating a new religion and a new philosophy which, Sir C. V. Raman felt sure, would replace beliefs that were founded not on demonstrable truth but were merely vestiges of man's animal ancestry.

* * *

Addressing the South Indian Science Association on the 6th. August 1932, on "Calcium Physiology", Dr. C. V. Natarajan, Superintendent, Public Health Institute, Bangalore, reviewed our present state of knowledge of the subject. Serum Calcium of normal Indian students had been determined and found to have an average of 10.2 Mgms. per 100 c.c. Determinations on a large number of Medical Students of normal health had been carried out, as also among diseased patients. Slight modifications in the technique of Kramer-Tisdall method for determining calcium were suggested so as to ensure constant results. Dr. Natarajan discussed bone-formation from the Embryological and Anatomical standpoint and also the problem of calcium deposition during ossification with special reference to the work of Robinson and his collaborators, regarding the enzyme found in certain cells (the ester on which the enzyme acts having been identified by P. A. Levine *et al* to be Glucose-6-phosphate) which acts in a manner so as to deposit calcium phosphate.

He detailed the functions of Calcium :—(i) in striped and unstriped muscle contractility, (ii) in impulse conduction in nerves, (iii) its importance in diarrhœal conditions, *i.e.*, the formation of Calcium Soaps, etc., (iv) the 'ion-antagonism' between Calcium, Potassium, Sodium and Magnesium ions, (v) Calcium significance in coagulation of Blood, (vi) the effect of irradiated ergosterol and the para-thyroid apparatus in the metabolism of Calcium, (vii) the physiological variations of the element in serum, in preparturient and lactating mothers and during the menstrual cycle, and surveyed the work of various scientists on these aspects of Calcium metabolism.

The appearance of rickets and osteomalacia among Indians is thought to be attributable to unbalanced dietary of the average Indian due to several factors, chief of which is the economical one. In spite of large quantities of *pan* (betel leaves) being chewn along with calcium hydroxide no remarkable increase of calcium had been noticed nor was there much propylaxis against diseases attributed to calcium deficiency.

* * *

An Ordinary Monthly Meeting of the Asiatic Society of Bengal was held on Monday, the 1st. August, 1932, at 5-30 p.m. The following communication was made :—

S. L. Hora.—*A Marine Air-Breathing Fish, Andamia heteroptera* Bleeker.

It is a well-known fact that a number of freshwater fishes of India, such as *Saccobranchus* (Singi), *Clarias* (Magur), *Anabas* (Koi), *Opicephalus* (Saul), etc., are capable of breathing air direct from the atmosphere to supplement their normal mode of respiration through the gills. This habit of aerial respiration has been regarded as an adaptation to life in shallow, stagnant, tropical, fresh waters which are liable to dry up during hot and dry months. A few species living in muddy ponds and rivers, and a few others living on muddy tropical shores or in mangrove swamps have taken to aerial respiration. All this implies that a medium poor in oxygen has induced the habit of breathing air in fishes. In support of this view it has been said that fishes typical of larger tropical lakes and truly marine fishes have not acquired this habit.

Andamia heteroptera is a marine fish that lives on rocks in the surf line on the shores of certain islands in the Indian Ocean. It is fairly common at Port Blair in the Andamans. The fish lives on rocks kept moist by a spray from the surf line, and continually changes its position with the tide. It is never found under water except for short periods when it may be accidentally submerged by the swell of the sea. In fact, it has been found experimentally that when individuals are kept under water, however highly oxygenated it may be and prevented from access to air, they die of asphyxiation. This shows that *Andamia* is a highly specialized air-breathing fish. What impelled this marine species to take to aerial respiration is difficult to say. The water near the surf line is highly oxygenated, and therefore, lack of oxygen cannot be the cause of this adaptation on the part of *Andamia*. The knowledge of the habit of this species has raised several points of biological interest which are now under investigaion. It is expected that much further light will be thrown on the origin and evolution of the terrestrial fauna.

A.S.B.

The Late Sir Dorabji Tata.

THE death of Sir Dorabji Tata has removed from the industrial life of India a great figure second only to his illustrious father, the late Mr. J. N. Tata. After setting the affairs of his firm on a sound footing, that great pioneer had conceived three great projects for the industrial and economic development of the country and set his whole heart on them during the last years of his life. But, while he had spent large sums of money in investigations relating to these schemes, he was not destined to initiate any one of them and it fell to Sir Dorabji to carry forward the work planned by his father. This he did with such energy and singleness of purpose that within ten years of his father's death, the wilderness of Sakchi had been transformed into a busy industrial city ; the rain waters of the western ghats had been harnessed and electric power transmitted to Bombay ; and the Indian Institute of Science had started on its ambitious work in Bangalore and already sent out its first batch of students. But Sir Dorabji was not satisfied with merely carrying out his father's plans. After carrying to completion these big schemes, he initiated a vigorous policy of expansion and, under his guidance, his firm launched forth on a long series of industrial enterprises including two more hydro-electric schemes, an industrial bank, an insurance company, oil and cement mills and an engineering construction company. Sir Dorabji was the chairman of most of these companies and fostered them with great care during the long years of economic depression that followed the end of the great war. He sometimes looked after the interests of these companies even at great personal sacrifice. During the dark days of the Tata Iron and Steel Company he nobly stood by its side and staked his own possessions and pledged his personal credit in support of the enterprise until Government came to its aid by granting bounties.

But he was more than a mere industrialist. He was a patron of learning and was deeply interested in the promotion of literary and scientific research which he endowed liberally. Since the foundation of the Indian Institute of Science he evinced a very keen interest in its progress and the welfare of its students. Under his guidance, the Tata Iron and Steel Company founded the Technological Institute at Jamshedpur for training Indians in the metallurgy of iron and steel. Both his private charities and public benefactions were mostly extended to deserving institutions and directed to the promotion of research. He endowed a Chair of Sanskrit in the Bhandarkar Institute at Poona and gave £ 25,000 to the University of Cambridge for the equipment of laboratories in the School of Engineering. He was also very keen on the establishment of a school of medical research in India and offered to endow it more than once, but the proposal did not materialise due to lack of support.

There were other sides to his life. Himself a cultivated man of great taste, he was a patron of fine arts and a great collector. His "Esplanade House" in Bombay contains valuable collection of art treasures and it was his wish that it should some day find a place in a public museum. He was also a patron of sports and athletics in which he himself excelled in his young days. He was very keen on seeing Indians win a name in the world of sport outside India and liberally supported Indian teams visiting other countries to take part in international games.

His fame chiefly rests on his great work in the field of industrial development during the past thirty years. But the man was greater than his work. He was a great gentleman, perfectly upright and universally respected for his high sense of honour and strict probity. He rigidly kept aloof from speculation and invariably guided his companions into the right path. He was above considerations of caste or creed. The last great act of his life was perhaps more characteristic of the man than all his industrial achievements. Shortly before his death he executed a trust for his entire property amounting to about three crores of rupees to be utilized for relieving human suffering

and promoting human welfare irrespective of caste or creed. He also set apart a sum of twenty-five lakhs for instituting research work on anæmia and allied malignant diseases, and for rewarding successful investigators in that direction.

F. N. MOWDAWALLA.

Reviews.

IN the series of the *Indian Zoological Memoirs* a recent publication which forms the 4th volume of this series, deserves mention. The Memoir is on the common Apple-snail (*Pila*) and is written by Dr. Baini Prashad, Superintendent, Zoological Survey of India. A complete account of the shell and anatomy of the mollusc, illustrated with 43 figures in the text, is given in this work, and a short chapter at the end deals with the directions for practical work for the students using this Memoir. The series is proving of great use to elementary students of Zoology working on Indian animal types, and it is hoped that it will be possible to continue publishing further memoirs in this series. The present memoir, like the preceeding ones, is published by the Methodist Publishing House, Lucknow, and its price is Rs. 2.

B.N.C.

Principles of Soil Microbiology. By Selman A. Waksman. Second Edition, pp. xxviii+894 (London: Bailliere, Tindall and Cox, 1931). Price, 52-6 net.

Prof. Waksman has rendered signal service to the cause of soil microbiology by the publication of a revised and amplified second edition of his already well-known 'Principles'.

The present publication marks a definite improvement on the first edition. Some of the older chapters have been abridged and re-written; others have been newly added, incorporating the more recent work on the decomposition of organic matter and on the relation between plant-growth and micro-organisms. The already extensive bibliography has been amplified to include all the important publcations of recent years. So complete is the information provided by the new edition that it deserves to be used as a volume of reference by those engaged in research.

While bearing ample testimony to the Herculean efforts of the author, the book betrays some of the limitations inevitable to a publication of its type. Owing to the vastness and the somewhat confused nature of the literature accumulating in different directions, many of the chapters read like threaded summaries from the card-index. The above together with the somewhat indifferent style, render the book rather unpalatable for the general reader who wishes to imbibe the principles of soil microbiology from its pages. The value of the bibliography has also been somewhat marred by the mistakes in citing some of the references.

The book has been well printed on good paper and, considering its size, is remarkably free from print mistakes. The price is unfortunately rather high and would not readily commend itself to the average purse.

V.S.

The Veterinary Bulletin, 1932, Volume 2, No. 2, pp. 65—130.

This Journal, which is a monthly from January 1932, aims at being an abstracting Journal dealing with current literature, and including references to all important British and foreign scientific work relating to veterinary research, administration, public health and education. The annual subscription is £ 2, and it is published by the Imperial Bureau of Animal Health, Weybridge, Surrey, England.

The February issue of the volume is of absorbing interest and contains extracts from or summaries of over 120 articles, arranged and classified under heading like the following:—*Diseases caused by Bacteria and Fungi, Diseases caused by Protozoan Parasites, Diseases caused by Filtrable Viruses, Diseases caused by Metazoan Parasites, etc.* One cannot but be struck by the care

with which the extracts have been made, and the skill displayed by the Editor and staff in dealng with them.

Of special interest to workers in diseases of animal pathology in India, are the reviews on articles contributed by workers on tuberculosis, its diagnosis and control, the diagnosis of Johne's disease using a "Bowel-Washing" method, the diagnosis of streptococcic mastitis, complications in sheep arising from the feeding of prikly pear, diseases caused by piroplasms, the control of cattle-plague in Dahomey, literature relating to foot-and-mouth disease, serum sickness in rabbits, the colon bacteria occurring in the milk-supply at Pusa and findings on investigations of other items of interest.

V.K.

Lt.-Col. R. B. Seymour Sewell, I.M.S., Director of the Zoological Survey of India, has published the 2nd part of his extensive studies on Copepoda of the Indian seas in Vol. X of the *Memoirs of the Indian Museum*. The part now published is a continuation of the work published in 1929 in the same volume. The Memoir is of exceptional interest and deals with all the species of *Calanoida* found in the Indian seas. In addition to the species examined by the author, references are given to all the forms recorded from the Indian region. The work is beautifully illustrated and should make the study of this difficult group easier for future workers. The particular feature of interest of this work is the record of the presence of small glands opening on the surface through pores in the chitinous covering. These glands, which had been recorded in the case of a few forms only, are now shown to occur much more widely in the group of the *Copepoda* dealt with by the author.

B.P.

Coming Events.

South Indian Science Association, Bangalore.

CENTRAL COLLEGE, BANGALORE

19th August, 1932.

'The Technique of Talkies', by Dr. L. C. Verman, M.A., Ph.D.

22nd August, 1932.

'Vegetable Ghee', by Mr. P. Ramaswamy Ayyar, M.A., A.I.I.Sc.

2nd September, 1932.

'Ordinary and Alloy Steels', by Mr. D. V. Krishna Rao, B.A.

Society of Biological Chemists (India).

17th August, 1932.

Mr. Nuggehalli Narayana, M.Sc.,A.I.C.,A.I.I.Sc., on 'Biological value of the proteins of some Indian foodstuffs'.

24th August, 1932.

Prof. V. Subrahmanyan, D.Sc., F.I.C., on 'The Present Agricultural Depression and a Solution'.

31st August, 1932.

Mr. M. Sreenivasaya, B.A., A.I.I.Sc., on 'Studies of Scars in relation to Sandal Spike'.

Current Science Rupee Fund.

An Appeal.

There is at present no Journal published in India which deals with all branches of scientific work. It has been felt for some time that a publication of this nature would assist in co-ordinating research and in supplying up-to-date scientific information. The matter was discussed by a number of the members of the Indian Science Congress at the Bangalore meeting last January, and it was unanimously agreed that such a Journal was most desirable and an influential Committee was formed to examine the scheme in detail.

It has now been decided to publish a monthly periodical with the title "Current Science". Many offers of help have been received, but before the scheme can be finally launched the financial position must be firmly secured. To effect this the Committee has decided to institute a "Rupee Fund" to which every one interested in science in India is requested to

contribute ONE RUPEE. There are few who cannot spare this small sum. If all were to help, the aggregate together with contributions already promised would suffice to relieve the Committee from pecuniary anxiety.

You are earnestly requested to hand your rupee to one of the gentlemen whose names are noted below or to forward it direct to K. S. Varadachar, Esq., Hon. Secretary, "Current Science," Indian Institute of Science, Bangalore.

Dr. S. S. Bhatnagar, D.Sc., University Chemical Laboratories, Lahore.

Dr. B. Dasannacharya, Ph.D., Professor of Physics, Benares Hindu University, Benares.

Mr. R. H. Dastur, M.Sc., Royal Institute of Science, Bombay.

Dr. P. B. Ganguly, D.Sc., Professor of Chemistry, College of Science, Patna.

Dr. J. C. Ghosh, D.Sc., Professor of Chemistry, Dacca University, Dacca.

Mr. K. D. Guha, Manager, Dairy Farm, Dayalbagh, Agra.

Dr. A. N. Kappanna, D.Sc., The University, Nagpur.

Mr. Khub Ram, M.A., M.Sc., Khub Ram Hostel, Delhi.

Dr. H. Parameswaran, D.Sc., F.Inst.P., Professor of Physics, Presidency College, Madras.

Mr. M. Raman Nair, B.A., A.I.I.Sc., Reader in Chemistry, University of Lucknow, Lucknow.

Mr. S. Ranganathan, M.Sc., A.I.I.Sc., Pasteur Institute, Coonoor.

Mr. M. Rangaswamy, B.A., A.I.I.Sc., Asst. Physico-Chemist, The Lac Research Institute, Ranchi.

Dr. M. N. Saha, F.R.S., University of Allahabad, Allahabad.

Dr. H. K. Sen, D.Sc., D.I.C., University College of Science, Calcutta.

Rai Bahadur Shiv Ram Kashyap, B.A., M.Sc., Professor of Botany, University of Punjab, Lahore.

Mr. B. N. Sreenivasaiah, M.Sc., Meteorological Office, Poona.

Rao Bahadur B. Viswanath, F.I.C., Government Agricultural Chemist, Coimbatore.

BANGALORE,
July 28, 1932.

The "Current Science"
Working Committee.

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